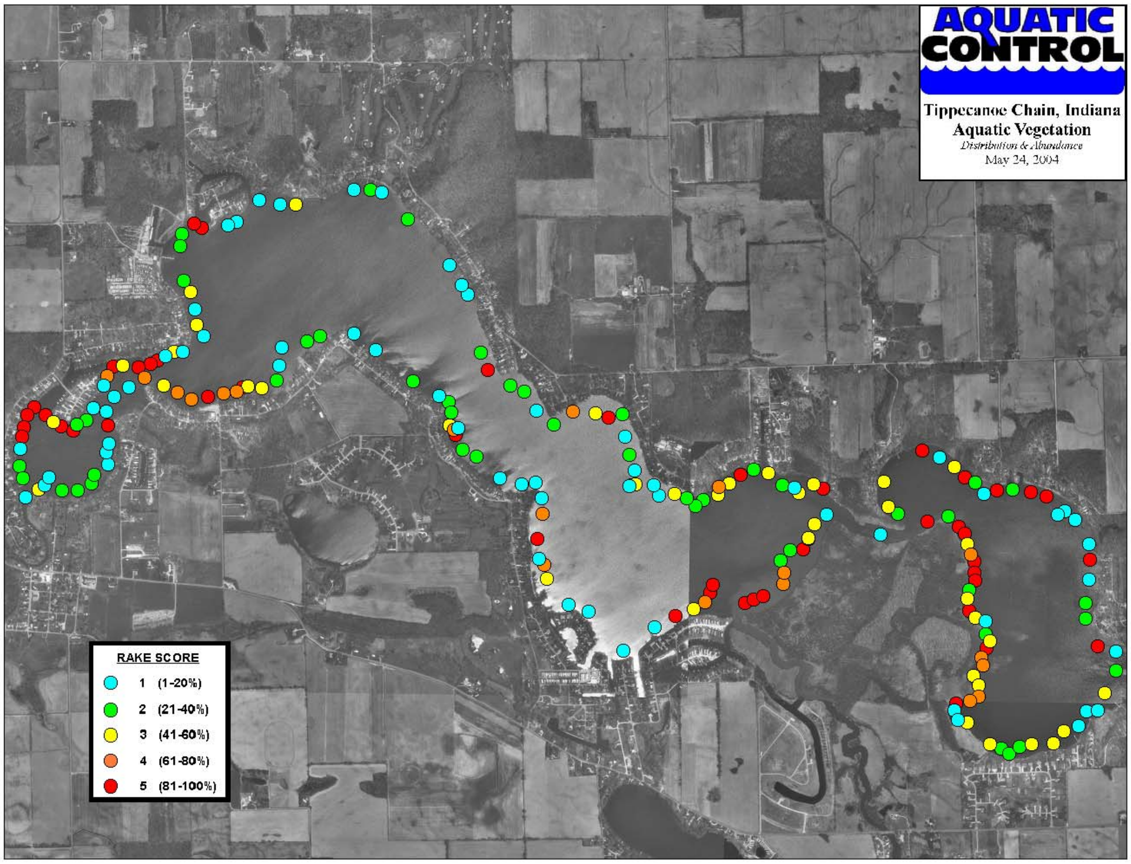

Lake Tippecanoe
Aquatic Vegetation Management Plan

February 15, 2005

Prepared for:
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Executive Summary

Aquatic Control was contracted by the Lake Tippecanoe Property Owners Association to complete aquatic vegetation sampling in order to update their lakewide, long-term integrated aquatic vegetation management plan. Funding for development of this plan was obtained from the Lake Tippecanoe Property Owners Association. This plan was created in order to more effectively document and control nuisance aquatic vegetation in Tippecanoe, James, and Oswego Lakes. This plan was also created as a prerequisite to eligibility for LARE program funding to control exotic or nuisance species.

Aquatic vegetation is an important component of lakes in Indiana; however, as a result of many factors this vegetation can develop to a nuisance level. Nuisance aquatic vegetation, as used in this paper, describes plant growth that negatively impacts the present uses of the lake including fishing, boating, swimming, aesthetic, and lakefront property values. The primary nuisance species within Lake Tippecanoe are the exotic plants Eurasian watermilfoil (*Myriophyllum spicatum*) and curlyleaf pondweed (*Potamogeton crispus*). The negative impact of these species on native aquatic vegetation, fish populations, water quality, and other factors is well documented and will be discussed in further detail. Eel grass (*Vallisneria Americana*) is also abundant in the Lake Tippecanoe chain in late summer. This species can also create nuisance situations around dock areas and boating lanes.

The primary recommendation for plant control within the Lake Tippecanoe chain includes the use of triclopyr herbicide to selectively control Eurasian watermilfoil throughout the lakes. This type of treatment should preserve and enhance the population of native vegetation and relieve nuisance conditions caused by Eurasian watermilfoil. Ideally, the objective is to eliminate this exotic species, but in a waterbody of this size, combined with inflow from other Eurasian watermilfoil infested lakes, this objective is likely not obtainable. A more realistic objective for this treatment is to maintain Eurasian watermilfoil below 10% frequency of occurrence in all three lakes and reduce relative density below 0.20. Currently, there is an abundant and diverse native population, and this should be at least maintained at current levels.

The Lake Tippecanoe POA has been funding triclopyr treatments since 2003, but on a limited basis. In 2003 and 2004 only the most severely impacted areas were managed. Funding should be made available to expand this relatively new and proven effective Eurasian watermilfoil treatment to all of the Tippecanoe chain in order to further reduce the negative effects caused by this exotic species. In addition to the triclopyr treatments, nuisance areas of curlyleaf pondweed should be treated in spring and nuisance areas of eel grass should be chemically treated in the late summer. Eel grass is an important native species that is beneficial to both fish and wildlife, so treatments should be limited to only the most impacted areas. Continued aquatic vegetation monitoring should take place on an annual basis in order to monitor the vegetation community and adjust management strategies as needed.

Acknowledgements

Funding for the vegetation sampling and preparation of an aquatic vegetation management plan was provided by the Lake Tippecanoe Property Owners Association. Aquatic Control, Inc. completed the field work, data processing, and map generation. Identification and verification of some plant specimens were provided by Dr. Robin Scribailo of Purdue University North Central. Special thanks are due to Mike Lattimer, Holly LaSalle, and Gary Calhoun of the Lake Tippecanoe Property Owners Association for their help in initiating and completing this project. Special thanks are given to Jed Pearson, District Fisheries Biologist for the Indiana Department of Natural Resources-Division of Fish And Wildlife, for his assistance with the plant sampling database and review of this plan. Special thanks are also given to Cecil Rich, Aquatic Biologist for the Indiana Department of Natural Resources for his review of this plan. Author of this report is Nathan Long of Aquatic Control. The author would like to acknowledge the valuable input from David Isaacs, Brian Isaacs, Joey Leach, and Barbie Huber of Aquatic Control for their field assistance, map generation, review, and editing of this report.

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Introduction

Aquatic Control was contracted by the Lake Tippecanoe Property Owners Association to complete aquatic vegetation sampling in order to create a lakewide, long-term integrated aquatic vegetation management plan. The study area included Oswego, James (Little Tippe), and Tippecanoe Lake. This plan was created in order to more accurately document the aquatic vegetation community and create a feasible plan for managing nuisance vegetation. The plan is also a prerequisite to eligibility for LARE program funding to control exotic or nuisance species.

The primary nuisance plant species in Lake Tippecanoe, James Lake, and Oswego Lake is the exotic species Eurasian watermilfoil. The exotic species curlyleaf pondweed and the native species eel grass can also reach nuisance levels. Due to the presence of large areas of deep water, these species typically only reach nuisance levels near shore around docks, swimming areas and boating lanes. In 2003 and 2004, the Lake Tippeacanoe POA raised funds for treatment of the densest areas of Eurasian watermilfoil and curyleaf pondweed. Management of man-made channels has been overseen by smaller associations and individual property owners.

The aquatic plant management goals of the Lake Tippecanoe Property Owners Association are as follows:

1. Prevent further water use impairment by aquatic plants.
2. Restore and maintain dock access for residents restricted by nuisance vegetation.
3. Maintain aquatic plant populations at levels and/or in areas that are beneficial to water quality protection and to fish and wildlife populations.
4. Maintain aquatic plant diversity through the intensive control of exotics.
5. Promote the use of environmentally sound aquatic plant management practices.
6. Provide educational and management tools to the Association for future years.

Watershed and Water Body Characteristics

Lake Tippecanoe, including James and Oswego lakes, is a 1,110 acre chain of natural lakes located 2 miles west of North Webster, Indiana (individually Oswego is 75 acres, Lake Tippecanoe is 763 acres and Lake James is 272 acres). It lies within the Tippecanoe River watershed and drains 72,320 acres. The water level is maintained by a dam built in 1936 at the west end of Oswego Lake. The main inlets enter from Lake Webster (Tippecanoe River), and the Barbee Lakes (Grassy Creek). With a maximum depth of 122 feet, it is the deepest natural lake in Indiana. The Tippecanoe Lake basin is steep-sided and has an average depth of 37 feet. The combined volume of the three basins is 35,230 acre-feet and their hydraulic retention time is 175 days. James Lake covers 272 acres, drains 35,776 acres and has a retention time of 73 days.

Farming is the major land use in the watershed, but small towns, woodlots, wetlands and lakes are present. Nearly all of the shoreline is residentially developed. Areas of natural shoreline and wetlands occur mainly between the Tippecanoe and James basins (Ball Wetland Area). A state owned boat ramp is available on Armstrong Road about 1 mile upstream on Grassy Creek. Several commercial marinas are also available.

Lake Tippecanoe in general is moderately fertile, although the Tippecanoe basin is less fertile. The trophic index for James Lake is 40, while indices in the Tippecanoe basin vary from 12-24. Historically, enough oxygen is present in summer for fish in the top 15-20 feet although 3-4 ppm are present down to 70 feet. Clarity varies from 5-6.5 feet. The bottom is muck, sand and marl (Pearson, 1995).

The Tippecanoe Environmental Lake and Watershed Foundation has obtained funding for projects aimed at improving water quality and reducing sedimentation. A recent project focused on construction of a sediment trap on Hanna B. Walker Drain, a tributary to Lake Tippecanoe. The project was designed as a stop-gap measure to intercept heavy sediment loads flowing into Lake Tippecanoe (J.F. New & Associates, 2000). The Tippecanoe Environmental Lake and Watershed Foundation along with the Lake Tippecanoe Property Owner's Association should continue to pursue funding for projects that will reduce sediments loads and improve water quality of the lakes. This should help insure the future of this valuable resource.

As previously mentioned, Lake Tippecanoe has a watershed that is conducive to siltation and phosphorus loading. This can lead to nuisance algae blooms, increased shallow areas, and an overall degradation of water quality. It should be a high priority to maintain and improve the overall water quality of the lakes; however, improvement of the watershed and reduction in phosphorus loading will not control nuisance macrophytes. Typically, as watersheds are improved, water clarity will increase. This in turn will increase light penetration and allow for vegetation to grow in deeper water. Submersed vegetation obtains the majority of necessary nutrients from the sediment and most Indiana sediments contain sufficient nutrients for plant growth. A study was recently completed by the Department of Fisheries and Aquatic Sciences at the University of Florida. The study compared the amount of available nutrients to plant growth. They sampled aquatic plants in 319 lakes between 1983 and 1999 and found no significant correlation between nutrients in lake water and the abundance of rooted aquatic plants (Bachman et. al., 2002).

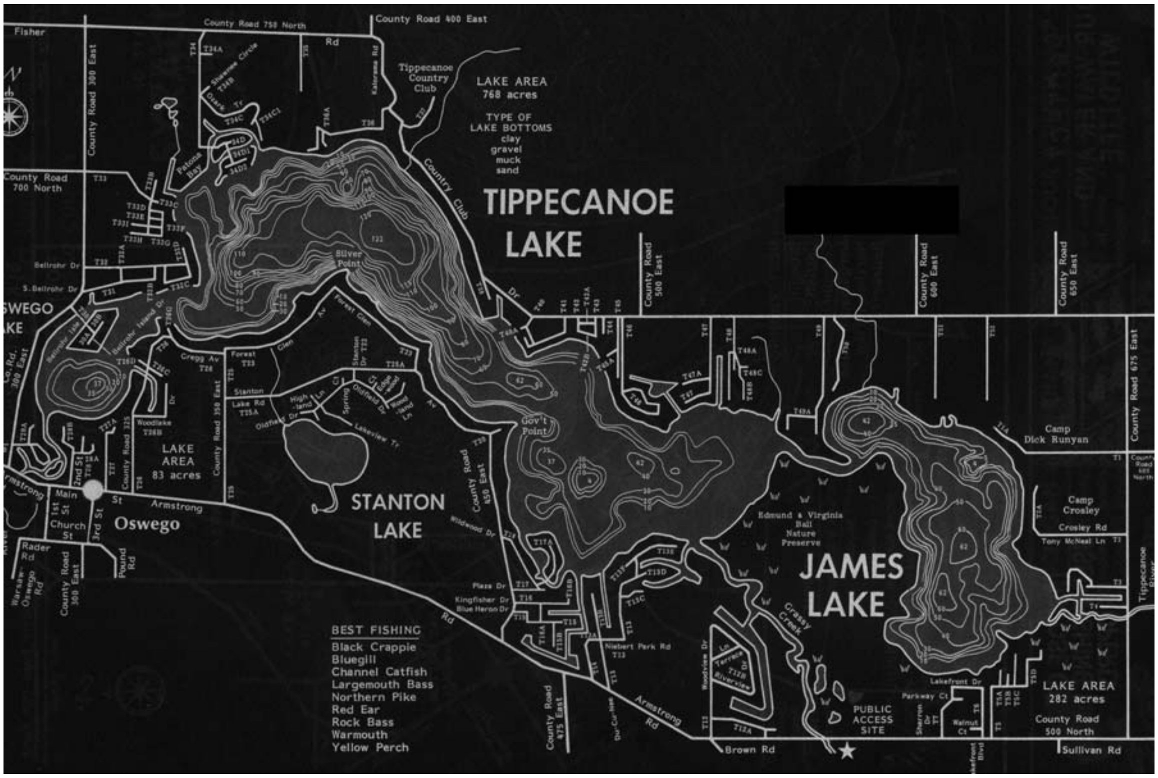

Figure 1. Bathymetric Map of Lake Tippecanoe (Bright Spot Maps, 1996)

Fisheries

The Indiana Department of Natural Resources manages the fishery in Lake Tippecanoe, James, and Oswego Lake. Fish population surveys have been conducted at Lake Tippecanoe on three occasions: July 1976, April 1982, and July 31-August 3, 1995. Recent management efforts at Lake Tippecanoe have focused on walleye (*Stizostedion vitreum*) and largemouth bass (*Micropterus salmoides*). From 1982-1986, about 430,000 walleye fingerlings were stocked. The stockings failed to provide an adequate density of walleyes. The stockings were discontinued after 1986. Annual estimates of largemouth bass abundance during 1983-1988 averaged 7.5 per acre. Densities in most area lakes are twice as much. Largemouth bass were sought by 24% of the anglers. Bluegill (*Lepomis macrochirus*), white bass (*Morone chrysops*) and crappie (*Pomoxis spp*.) are also popular species at these lakes. Muskie (*Esox masquinongy*) have recently been introduced and are increasingly popular with fishermen throughout the state. This species prefers relatively dense plant beds. There appears to be sufficient native vegetation present in the Tippecanoe chain so that reduction of nuisance exotic species will likely have no effect on muskie populations.

The most recent complete fish survey on the Tippecanoe chain was conducted in late July and early August 1995. Effort during this survey included 1 hour of DC electrofishing, eight gill net lifts, and eight trap net lifts. A total of 837 fish were collected weighing 482 pounds and comprising thirty species. Bluegill was the most abundant species collected (35%), followed by gizzard shad (*Dorosoma cepedianum*) (29%), largemouth bass (9%), and channel catfish (*Ictalurus punctatus*) (5%). The electrofishing catch of bluegill was low compared to other lakes in the area. Bluegill weights and growth were average. The catch rate of bass was slightly below normal. Largemouth bass weights and growth were also average. No management recommendations were suggested following the survey (Pearson, 1995). Table 1 is a list of species collected during past three population surveys.

Table 1. Number of fish collected during fish population surveys at Lake Tippecanoe from 1976-95 (Pearson, 1995)

Species	1976	1982	1995
Bluegills	655	166	295
Bullheads	32	68	7
Catfish	22	29	40
Crappies	70	69	9
Perch	145	186	31
Pike	9	34	1
Redear	76	3	24
White Bass	9	18	12
Other Sunfish	155	18	30
LM Bass	131	75	74
SM Bass	1	15	3
Carp	9	3	2
Gar	50	1	12
Shad	384	37	244
Suckers	76	107	28
Others	227	58	25
Total	2051	887	837

Aquatic vegetation is an important component in fisheries management. However, dense vegetation, especially Eurasian watermilfoil, can have negative effects of fish growth. Dr. Mike Maceina of Auburn University found that dense stands of Eurasian watermilfoil on Lake Guntersville proved to be detrimental to bass reproduction due to the survival of too many small bass. This led to below normal growth rates for largemouth bass and lower survival to age 1. Maceina found higher age 1 bass density in areas that contained no plants verses dense Eurasian watermilfoil stands (Maceina, 2001). Bluegill growth rates can also be affected by dense stands of Eurasian watermilfoil. It is well known by fisheries biologists that overabundant dense plant cover gives bluegill an increased ability to avoid predation and increases the survival of small young fish, which can lead to stunted growth.

Present Water Body Uses

Nearly the entire shoreline of the Lake Tippecanoe chain is residentially developed. The main undeveloped area is the Ball Wetland located between Lake Tippecanoe and James Lake (Figure 2). A majority of the residents own fishing or pleasure boats. At a recent meeting held to discuss this management plan, fishing, swimming, and boating were chosen as the primary uses of Lake Tippecanoe. A public access site is located in Grassy Creek about 1-mile upstream from Lake Tippecanoe. Several private ramps and marinas are present at Lake Tippecanoe. During the summer months, the Tippecanoe chain is a very popular boating and water skiing lake. At the November public meeting many residents voiced concern over the congested conditions of the lake that were experienced during summer weekends.

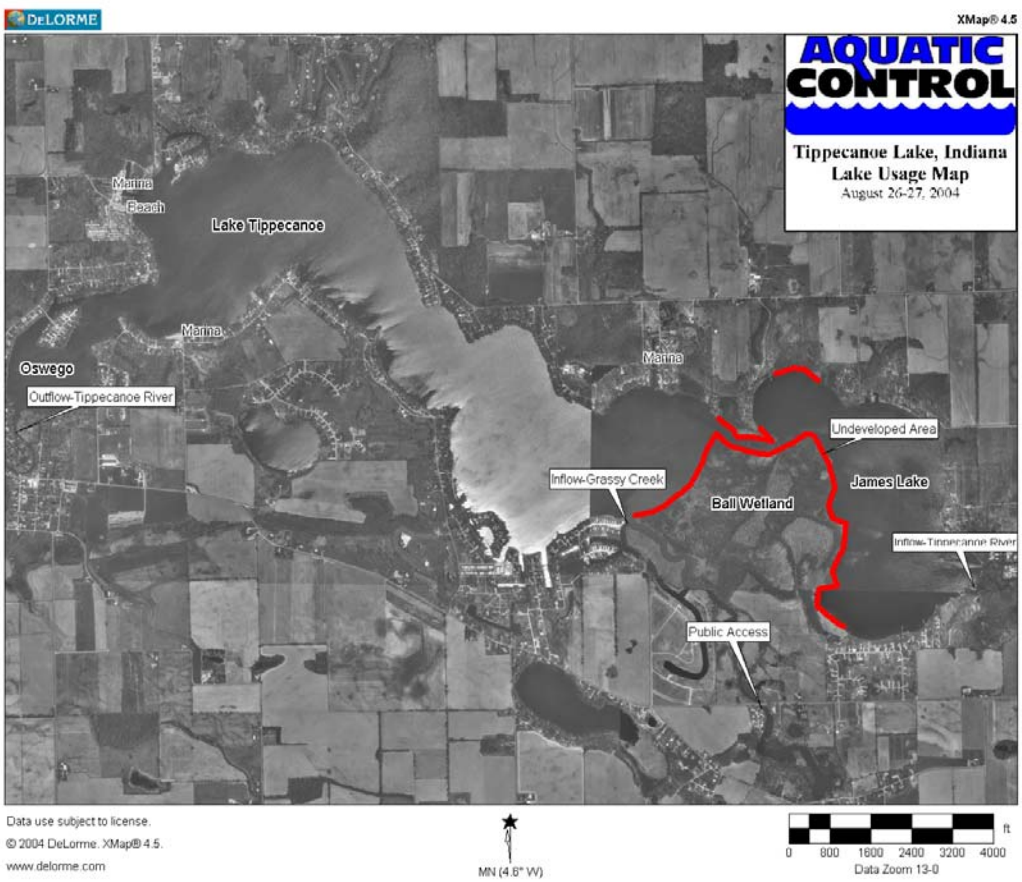

Figure 2. Lake Usage Map (not to scale see appendix)

Aquatic Plant Community

Aquatic vegetation sampling must be completed in order to create an effective aquatic vegetation management plan. In 1995, IDNR completed brief vegetation sampling prior to conducting a fish survey. Eel grass was defined as common and milfoil was considered abundant (Pearson, 1995). The Lake Tippecanoe POA has been funding vegetation sampling since 2002. Aquatic Control Inc. completed surveys in the late summer of 2002, spring of 2003, and spring and late summer of 2004.

The 2002 and 2003 surveys were similar to the Tier I survey which will be discussed later in this report, but differed enough to make a good comparison difficult. Sample sites were randomly selected throughout the littoral zone of the Tippecanoe chain and vegetation was given an abundance rating based on a visual estimate (these surveys did not break up the chain into individual lakes). A total of 228 sample sites were included in the 2002 survey. Submersed vegetation was observed, recorded, and given density rankings. Rakes were thrown if plants could not be identified from the surface. In the late summer 2002 survey, plants were growing to a depth of 17 feet and considered dense at 42% of the 228 sample sites. A total of 25 species were observed. The most abundant species was eel grass followed by variable pondweed (*Potamogeton gramineus*), sago pondweed (*Potamogeton pectinatus*), and coontail (*Ceratophyllum demersum*). The exotic species Eurasian watermilfoil occurred at 31.1% of sampling sites (Shuler, 2003).

Another plant survey was conducted May 8, 2003 using the same sampling procedure as above. Plants were present to a depth of 16 feet. A total of 16 species were observed and considered dense at 32% of 245 sampling sites. The exotic species curlyleaf pondweed was the most abundant species followed by chara (*Chara spp.*), coontail, and Eurasian watermilfoil. The primary recommendations from this survey was to focus on the control of Eurasian watermilfoil and curlyleaf pondweed. It was also recommended that the native species eel grass and chara may need to be controlled in areas where these species are creating nuisance conditions. Another recommendation from this survey was for the Tippecanoe POA to work towards a whole lake chain aquatic plant management program that is solely funded and administered by the POA. Currently many individuals are hiring different applicators to treat their lots and channels (Shuler, 2004).

May 25, 2004 Tier II Survey

In 2004, the POA requested spring and summer sampling. Aquatic Control completed the first sampling on May 24, 2004. This sampling was conducted prior to the release of the LARE program sampling protocol. However, the May 2004 sampling methods were changed in order to use a new method that was currently in use by IDNR fisheries biologists. This sampling method turned out to be the same protocal which is now required for LARE funding and is referred to as Tier II sampling. LARE also requires completion of a Tier I survey. Tier I sampling was not conducted in May because the criteria had not been released at that time. However, a Tier I survey was completed in August.

The Tier II survey helps meet the following objectives:

1. to document the distribution and abundance of submersed and floating-leaved aquatic vegetation
2. to compare present distribution and abundance with past distribution and abundance within select areas (IDNR, 2004).

All of the data which was collected through the use of this protocol was recorded on standardized data sheets. The data collected was compared to data collected by district fisheries biologist Jed Pearson, which is presented in his 2004 paper "A Sampling Method to Assess Occurrence, Abundance, and Distribution of Submersed Aquatic Plants in Indiana Lakes". In this paper, Pearson used 21 northern Indiana lakes to calculate various aquatic plant abundance and diversity metrics. The sampling procedure outlined in Pearson's paper was used to calculate these same metrics for Lake Tippecanoe (Table 3). The data collected will also be valuable for future comparison, which will document changes in the plant community following proposed management activities.

Sample sites were randomly selected within the littoral zone (the number of sample sites is dependent on lake size). Once a site was reached the boat was slowed to a stop and the coordinates were recorded on a hand-held GPS unit and later downloaded into a mapping program. A depth measurement was taken by dropping a two-headed standard sampling rake that was attached to a rope marked off in 1-foot increments (Figure 3). An additional ten feet of rope was released and the boat was reversed at minimum operating speed for a distance of ten feet. Once the rake is retrieved the overall plant abundance on the rake is scored from 1-5 and then individual species are placed back on the rake and scored separately (the rake is marked off in 5 equal sections on the tines, see Figure 3).

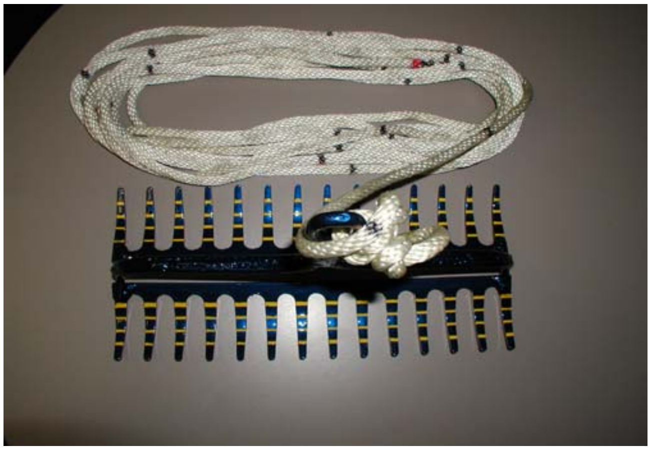

Figure 3. Sampling Rake

Oswego Lake, May 2004 Tier II Survey

Tier II sampling took place on May 24, 2004. Plants were present to a maximum depth of 24 feet. Thirty-three sites were randomly selected within the littoral zone (40 sites are required for a lake of this size, but the 2003 waypoints were used in the May sampling). The mean rake density score for Oswego Lake was 2.58. Species richness (average number of species per site) was 1.88 for all species and 1.09 for natives only. Site species diversity index was 0.79 for all species and 0.66 for native species only. Oswego

Lake had a rake diversity score of 0.77 for all species and 0.63 for natives only (Table 2). Figure 4 illustrates the location and density of submersed vegetation.

Table 2. Oswego Lake vegetation abundance, density, and diversity metrics compared to average, May 24, 2004

	Oswego Lake*	Average**
Percentage of littoral sites with vegetation	97%	-
# of species collected	8	8
# of native species collected	6	7
Mean Rake Density	2.58	3.30
Rake Diversity (SDI)	0.77	0.62
Native Rake Diversity (SDI)	0.63	0.50
Species Richness (Avg # spec./site)	1.88	1.61
Native Species Richness	1.09	1.33
Site Species Diversity	0.79	0.66
Site Species native diversity	0.66	0.56

*standard deviation not included
**average calculated from Pearson Data.

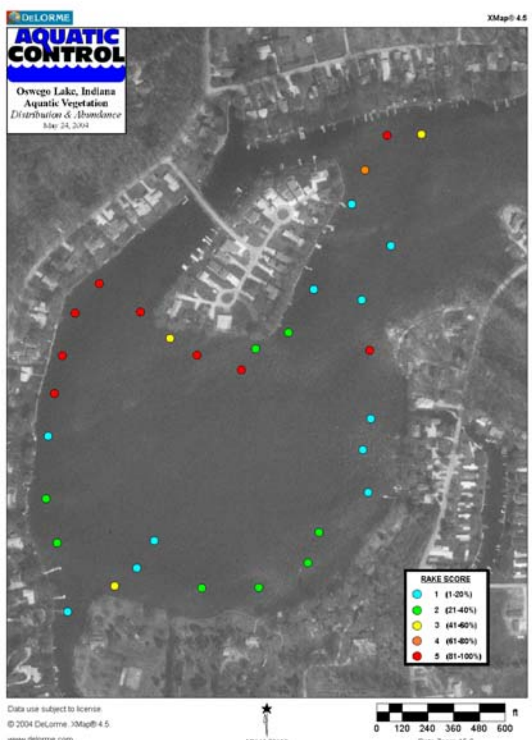

Figure 4. Oswego Lake, aquatic vegetation distribution and abundance, May 24, 2004 (not to scale see appendix)

Table 3 illustrates frequency of occurrence, relative density, and dominance index of individual species. A total of 8 species were collected of which 6 of the species were natives. Eurasian watermilfoil and curlyleaf pondweed were the exotic species collected. Coontail was present at the highest percentage of sample sites (57.6%) (Figure 5), followed by Eurasian watermilfoil (51.5%) (Figure 6), curlyleaf pondweed (27.3%) (Figure 7), chara (21.2%) (Figure 8), sago pondweed (17.5%), eel grass (12.1%), variable pondweed (12.1%), flatstem pondweed (*Potamogeton zosteriformis*) (3.0%) (Figure 9), and horned pondweed (*Zannichellia palustris*) (3.0%). At the time of the survey, Eurasian watermilfoil had the highest relative density.

Table 3. Oswego Lake, species collected during Tier II sampling, May 24, 2004

Common Name	Scientific Name	Frequency of Occurrence	Relative Density*	Dominance Index**
Coontail	*Ceratophyllum demersum*	57.6%	0.79	15.8
Eurasian watermilfoil	*Myriophyllum spicatum*	51.5%	1.12	22.4
Curlyleaf pondweed	*Potamogeton crispus*	27.3%	0.73	14.5
Chara	*Chara spp.*	21.2%	0.39	7.9
Sago pondweed	*Potamogeton pectinatus*	17.5%	0.30	2.4
Eel grass	*Vallisneria americana*	12.1%	0.12	2.4
Variable pondweed	*Potamogeton gramineus*	12.1%	0.12	2.4
Flatstem pondweed	*Potamogeton zosteriformis*	3.0%	0.03	0.03
Horned pondweed	*Zannichellia palustris*	3.0%	0.03	0.03

*Mean rake score at all sites
**Percent of Maximum Abundance

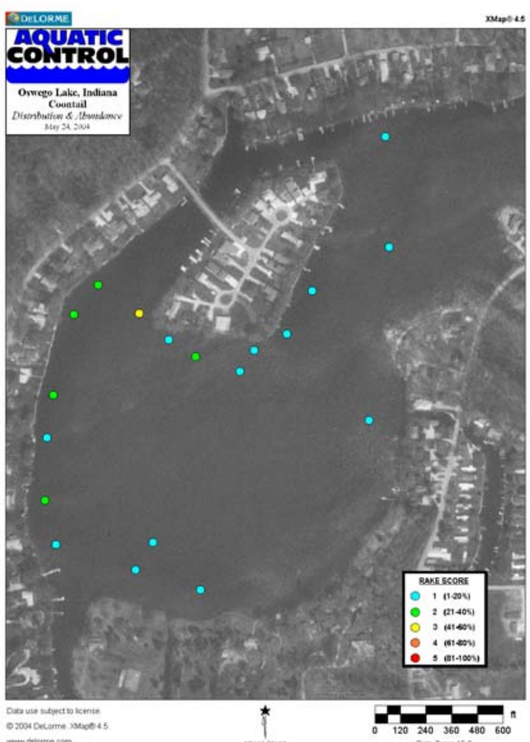

Figure 5. Oswego Lake, coontail distribution and abundance, May 24, 2004 (not to scale see appendix)

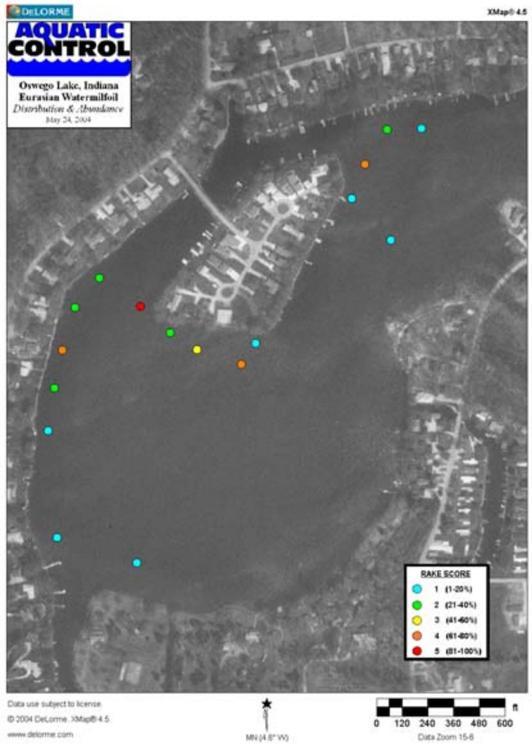

Figure 6. Oswego Lake, Eurasian watermilfoil distribution and abundance, May 24, 2004 (not to scale see appendix)

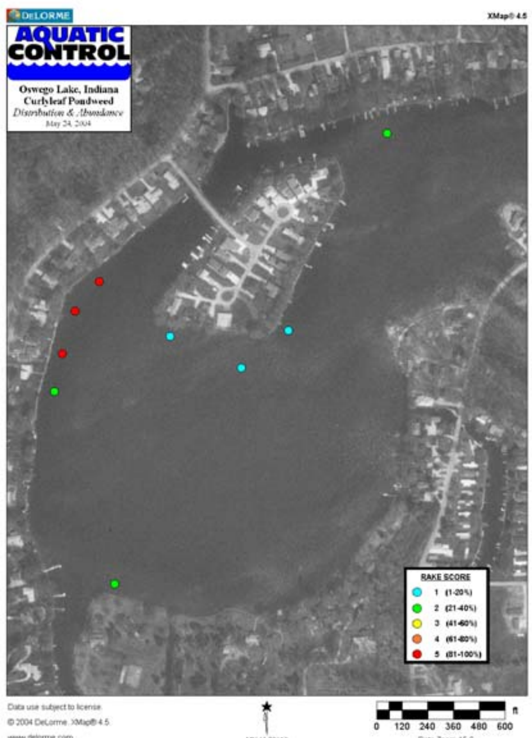

Figure 7. Oswego Lake, curlyleaf pondweed distribution and abundance, May 24, 2004 (not to scale see appendix)

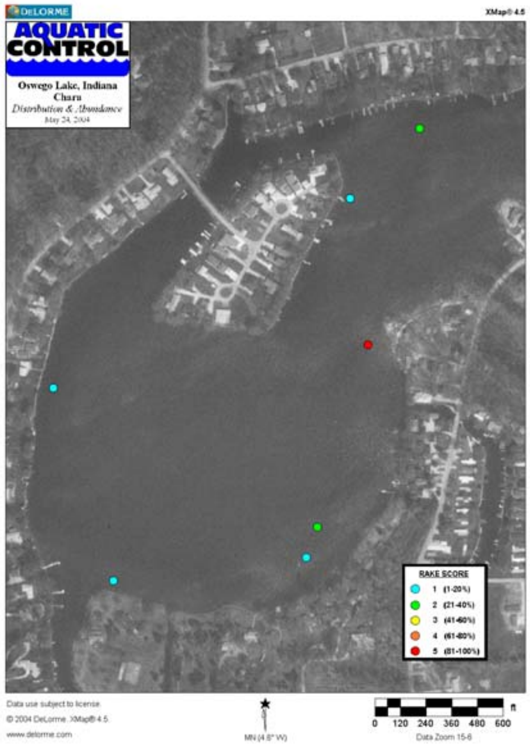

Figure 8. Oswego Lake, chara distribution and abundance, May 24, 2004 (not to scale see appendix)

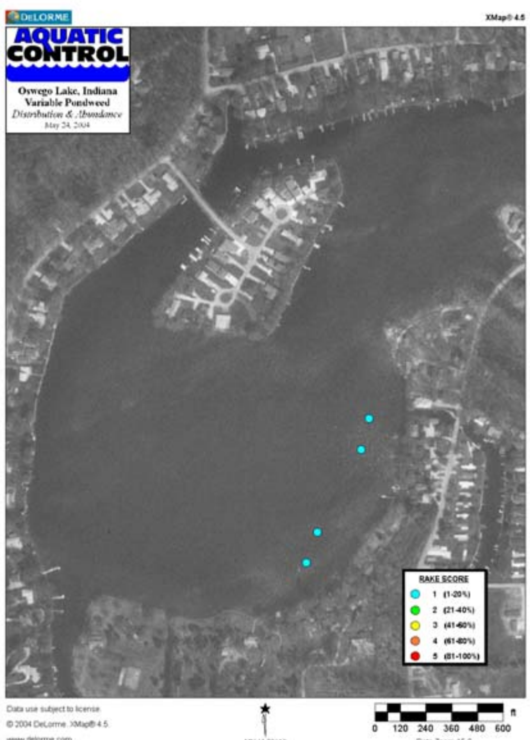

Figure 9. Oswego Lake, variable pondweed distribution and abundance, May 24, 2004 (not to scale see appendix)

Lake Tippecanoe, May 2004 Tier II Survey

Lake Tippecanoe Tier II sampling also took place on May 25, 2004. Plants were present to a maximum depth of 17 feet. One hundred and forty sites were randomly selected within the littoral zone. The mean rake density score for Lake Tippecanoe was 2.26. Species richness (average number of species per site) was 1.66 for all species and 0.97 for natives only. Site species diversity index was 0.83 for all species and 0.79 for native species only. Lake Tippecanoe had a rake diversity score of 0.78 for all species and 0.74 for natives only (Table 4). Distribution and density of submersed vegetation is illustrated in Figure 10.

Table 4. Lake Tippecanoe vegetation abundance, density, and diversity metrics compared to average, May 25, 2004

	Lake Tippecanoe*	Average**
Percentage of littoral sites with vegetation	89%	-
# of species collected	12	8
# of native species collected	10	7
Mean Rake Density	2.26	3.30
Rake Diversity (SDI)	0.78	0.62
Native Rake Diversity (SDI)	0.74	0.50
Species Richness (Avg # spec./site)	1.66	1.61
Native Species Richness	0.97	1.33
Site Species Diversity	0.83	0.66
Site Species native diversity	0.79	0.56

*standard deviation not included
**average calculated from Pearson Data.

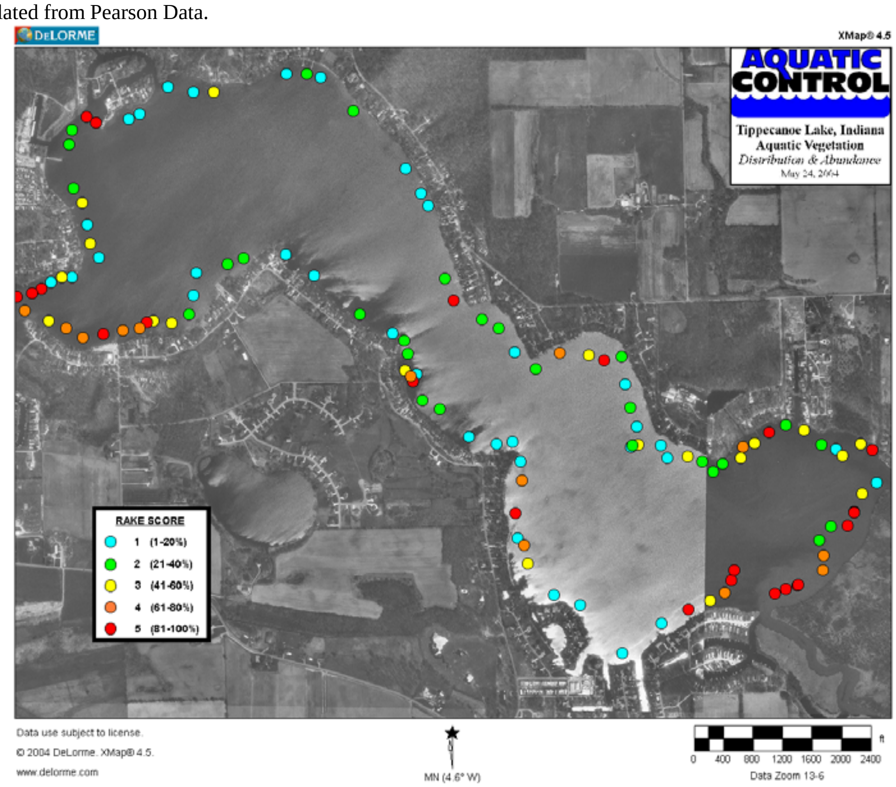

Figure 10. Lake Tippecanoe, aquatic vegetation distribution and abundance, May 24, 2004 (not to scale see appendix)

Table 5 illustrates frequency of occurrence, relative density, and the dominance index of individual species. A total of 12 species were collected of which 10 of the species were natives. Eurasian watermilfoil and curlyleaf pondweed were the exotic species collected. Curlyleaf pondweed was present at the highest percentage of sample sites (45.7%) (Figure 11), followed by chara (30.7%) (Figure 12), Eurasian watermilfoil (22.9%) (Figure 13), flatstem pondweed (19.3%) (Figure 14), variable pondweed (16.4%) (Figure 15), coontail (13.6%) (Figure 16), eel grass(12.9%), and horned pondweed (1.4%). Water stargrass (*Zosterella dubia*), whorled watermilfoil (*Myriophyllum verticillatum*), American elodea (*Elodea canidensis*), and common bladderwort (*Utricularia vulgaris*) were present at only one site.

Table 5. Lake Tippecanoe, species collected during Tier II sampling, May 25, 2004

Common Name	Scientific Name	Frequency of Occurrence	Relative Density*	Dominance Index**
Curlyleaf pondweed	*Potamogeton crispus*	45.7%	1.06	21.1
Chara	*Chara spp.*	30.7%	0.60	12.0
Eurasian watermilfoil	*Myriophyllum spicatum*	22.9%	0.31	6.1
Flatstem pondweed	*Potamogeton zosteriformis*	19.3%	0.24	4.7
Variable pondweed	*Potamogeton gramineus*	16.4%	0.16	3.3
Coontail	*Ceratophyllum demersum*	13.6%	0.23	4.6
Eel grass	*Vallisneria Americana*	12.9%	0.14	2.9
Horned pondweed	*Zannichellia palustris*	1.4%	0.01	0.3
Water stargrass	*Zosterella dubia*	0.7%	0.01	0.1
Whorled watermilfoil	*Myriophyllum verticillatum*	0.7%	0.01	0.1
American elodea	*Elodea canidensis*	0.7%	0.01	0.1
Common bladderwort	*Utricularia vulgaris*	0.7%	0.01	0.1

*Mean rake score at all sites
** Percent of Maximum Abundance

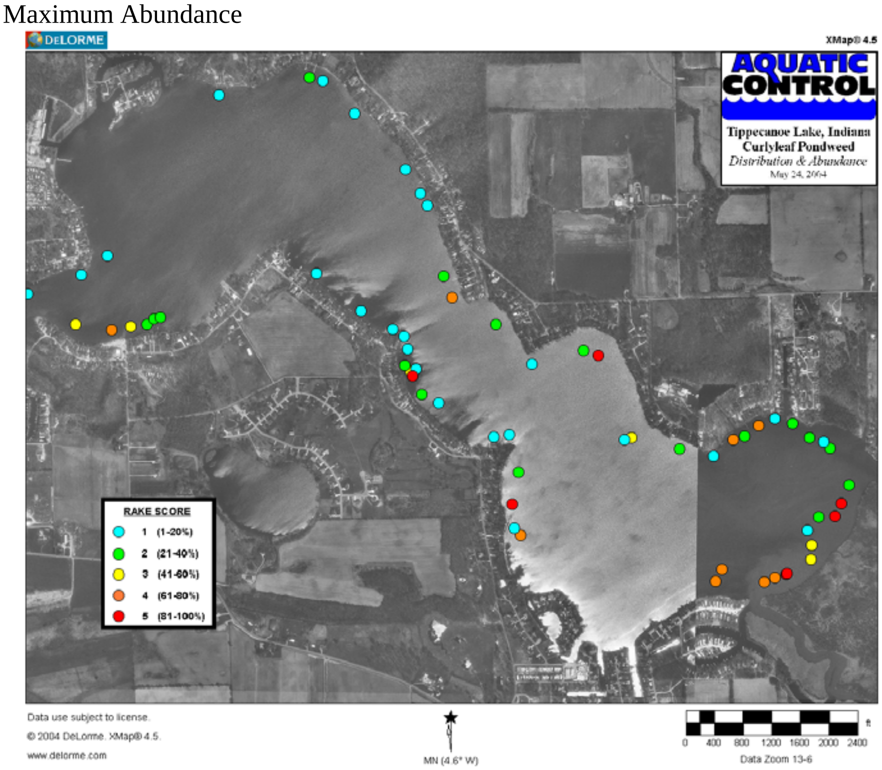

Figure 11. Lake Tippecanoe, curlyleaf pondweed distribution and abundance, May 24, 2004 (not to scale see appendix)

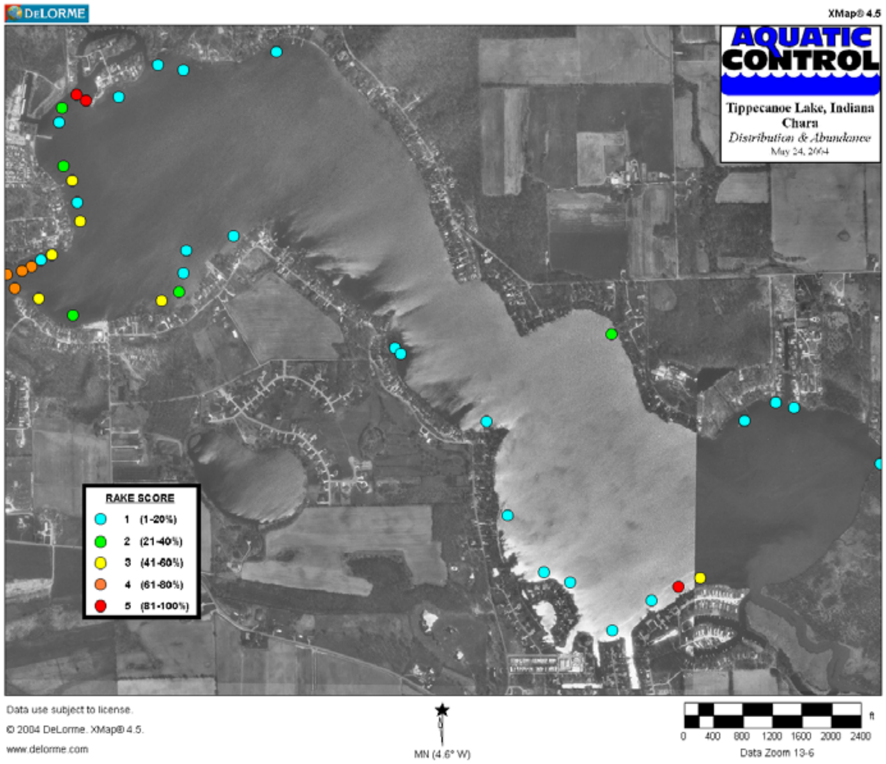

Figure 12. Lake Tippecanoe, chara distribution and abundance, May 24, 2004 (not to scale see appendix)

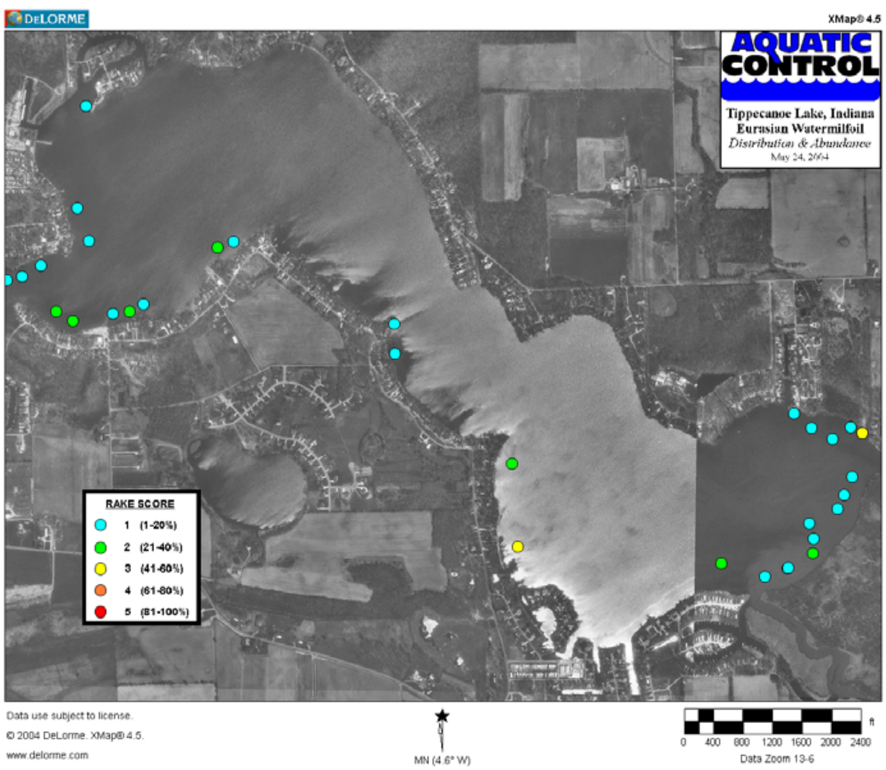

Figure 13. Lake Tippecanoe, Eurasian watermilfoil distribution and abundance, May 24, 2004 (not to scale see appendix)

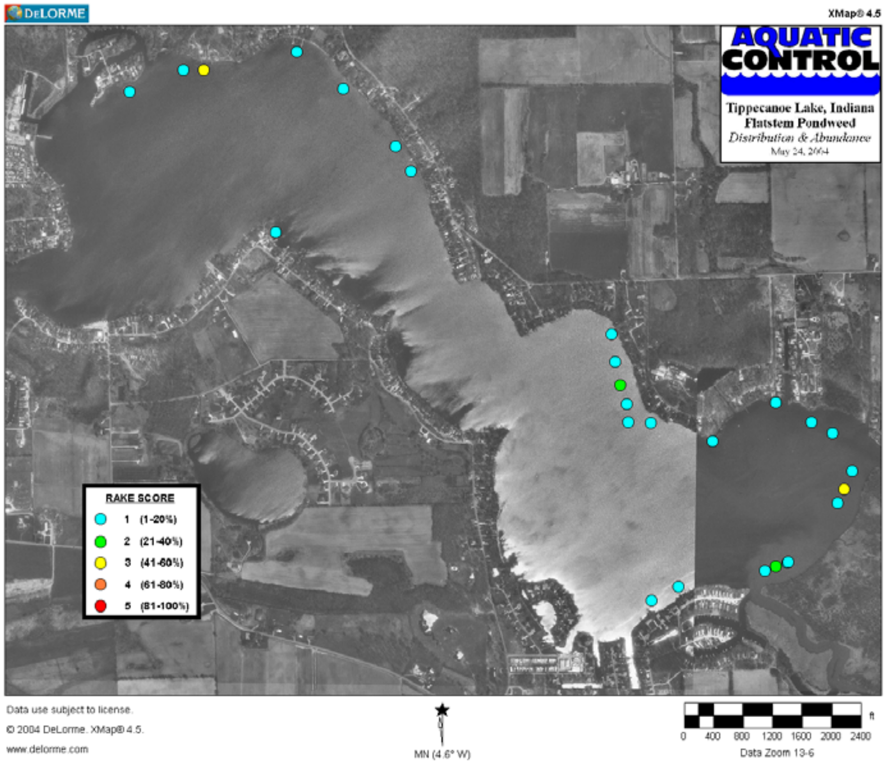

Figure 14. Lake Tippecanoe, flatstem pondweed distribution and abundance, May 24, 2004 (not to scale see appendix)

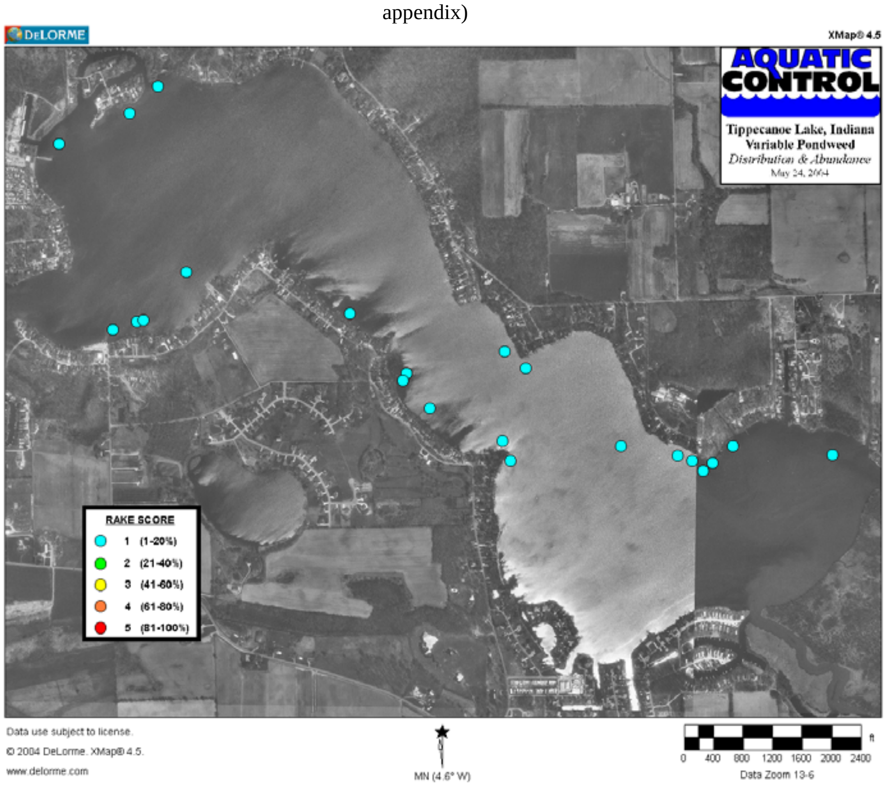

Figure 15. Lake Tippecanoe, variable pondweed distribution and abundance, May 24, 2004 (not to scale see appendix)

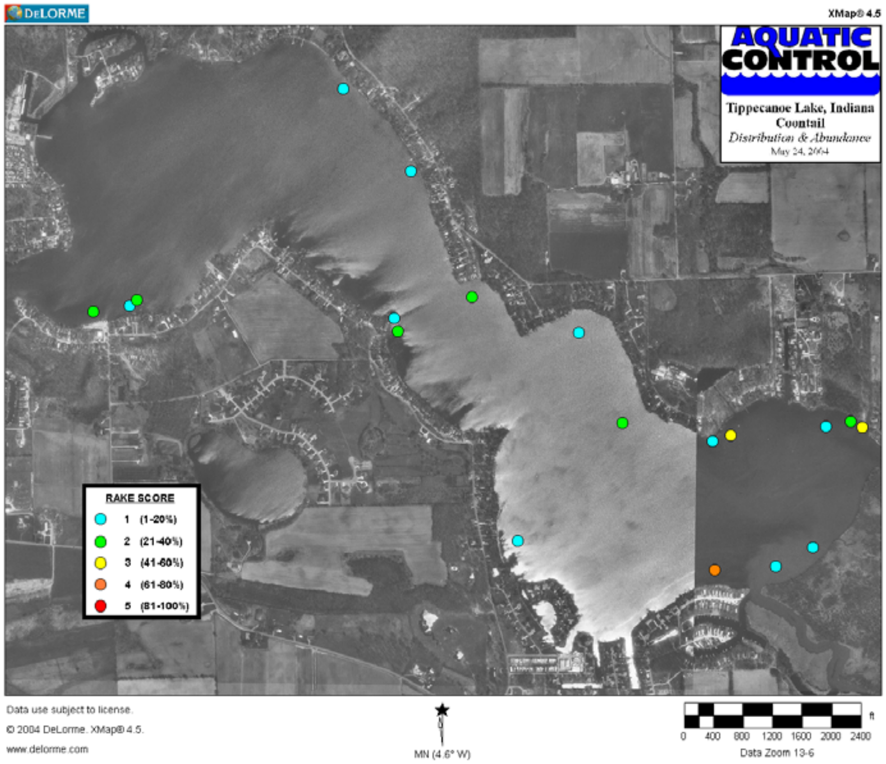

Figure 16. Lake Tippecanoe, coontail distribution and abundance, May 24, 2004 (not to scale see appendix)

James Lake, May 2004 Tier II Survey

James Lake Tier II sampling took place on May 25, 2004. Seventy-four sites were randomly selected within the littoral zone. Plants were present to a maximum depth of 15 feet. The mean rake density score for James Lake was 2.47. Species richness (average number of species per site) was 1.65 for all species and 1.09 for natives only. Site species diversity index was 0.80 for all species and 0.71 for native species only. James Lake had a rake diversity score of 0.76 for all species and 0.65 for natives only (Table 6). Figure 17 illustrates the distribution and density of submersed vegetation.

Table 6. James Lake vegetation abundance, density, and diversity metrics compared to average, May 25, 2004

	James Lake *	Average**
Percentage of littoral sites with vegetation	90%	-
# of species collected	11	8
# of native species collected	9	7
Mean Rake Density	2.47	3.30
Rake Diversity (SDI)	0.76	0.62
Native Rake Diversity (SDI)	0.65	0.50
Species Richness (Avg # spec./site)	1.65	1.61
Native Species Richness	1.09	1.33
Site Species Diversity	0.80	0.66
Site Species native diversity	0.71	0.56

*standard deviation not included
**average calculated from Pearson Data.

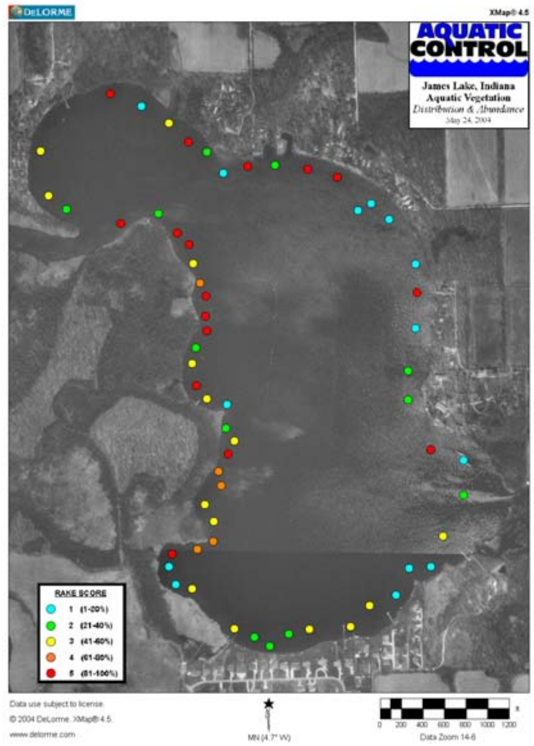

Figure 17. James Lake, aquatic vegetation abundance and distribution and abundance, May 24, 2004 (not to scale see appendix)

Table 7 illustrates frequency of occurrence, relative density, and the dominance index of individual species collected from James Lake. A total of 11 species were collected of which 9 of the species were natives. Eurasian watermilfoil and curlyleaf pondweed were the exotic species collected. Curlyleaf pondweed and coontail were present at the highest percentage of sample sites (43.2%) (Figure 18 & 19), followed by chara (36.5%) (Figure 20), flatstem pondweed (18.9%) (Figure 21), Eurasian watermilfoil (12.2%) (Figure 22), horned pondweed (4.1%), variable pondweed (2.7%) (Figure 23), eel grass (1.4%), American elodea (1.4%), largeleaf pondweed (*Potamogeton amplipholius*) (1.4%), and bur marigold (*Bidens beckii*) (1.4%).

Table 7. James Lake, species collected during Tier II sampling, May 25, 2004

Common Name	Scientific Name	Frequency of Occurrence	Relative Density*	Dominance Index**
Curlyleaf pondweed	*Potamogeton crispus*	43.2%	1.01	20.3
Coontail	*Ceratophyllum demersum*	43.2%	0.91	18.1
Chara	*Chara spp.*	36.5%	0.69	13.8
Flatstem pondweed	*Potamogeton zosteriformis*	18.9%	0.20	4.1
Eurasian watermilfoil	*Myriophyllum spicatum*	12.2%	0.19	3.8
Horned pondweed	*Zannichellia palustris*	4.1%	0.04	0.8
Variable pondweed	*Potamogeton gramineus*	2.7%	0.04	0.5
Eel grass	*Vallisneria americana*	1.4%	0.01	0.3
American elodea	*Elodea canidensis*	1.4%	0.04	0.8
Largeleaf pondweed	*Potamogeton amplipholius*	1.4%	0.01	0.3
Bur marigold	*Bidens beckii*	1.4%	0.01	0.3

*Mean rake score at all sites
**Percent of Maximum Abundance

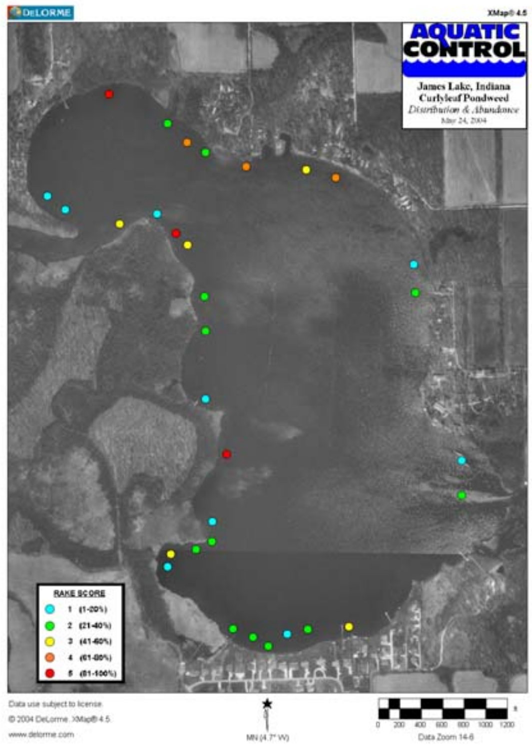

Figure 18. James Lake, curlyleaf pondweed abundance and distribution and abundance, May 24, 2004 (not to scale see appendix)

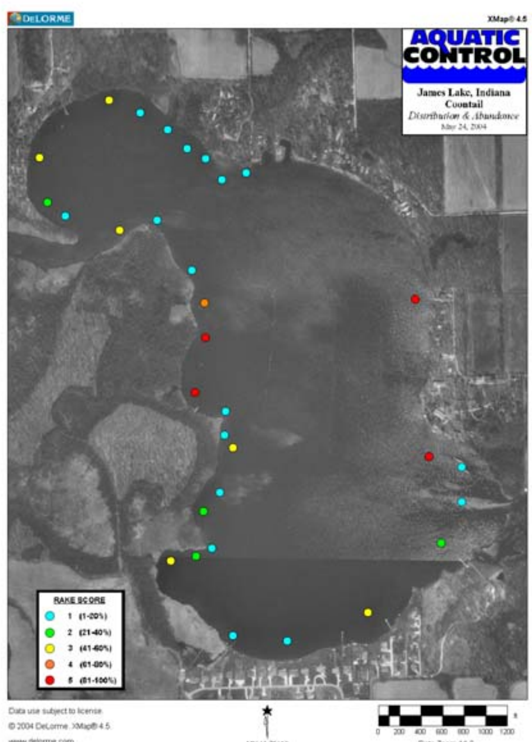

Figure 19. James Lake, coontail abundance and distribution and abundance, May 24, 2004 (not to scale see appendix)

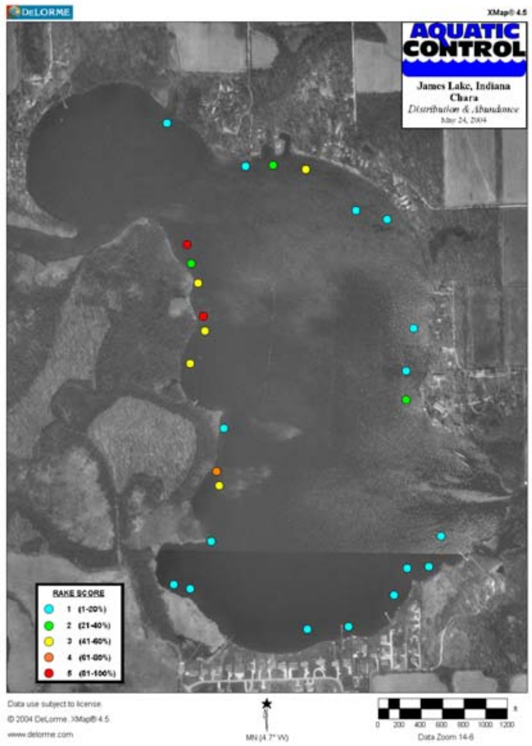

Figure 20. James Lake, chara abundance and distribution and abundance, May 24, 2004 (not to scale see appendix)

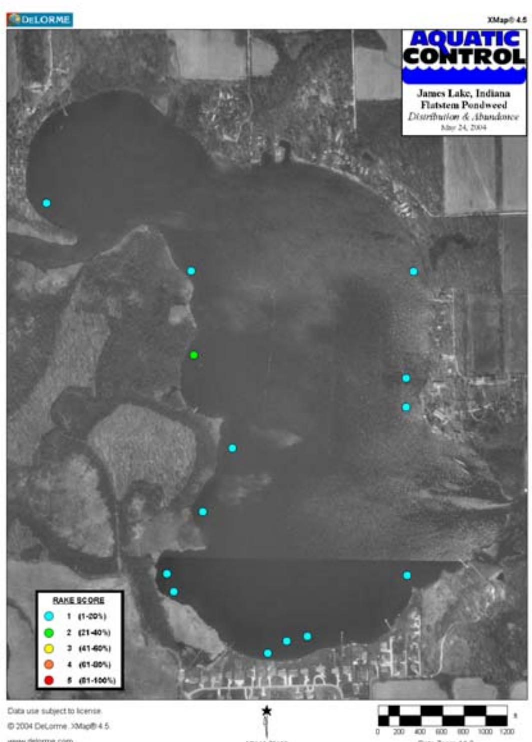

Figure 21. James Lake, flatstem pondweed abundance and distribution and abundance, May 24, 2004 (not to scale see appendix)

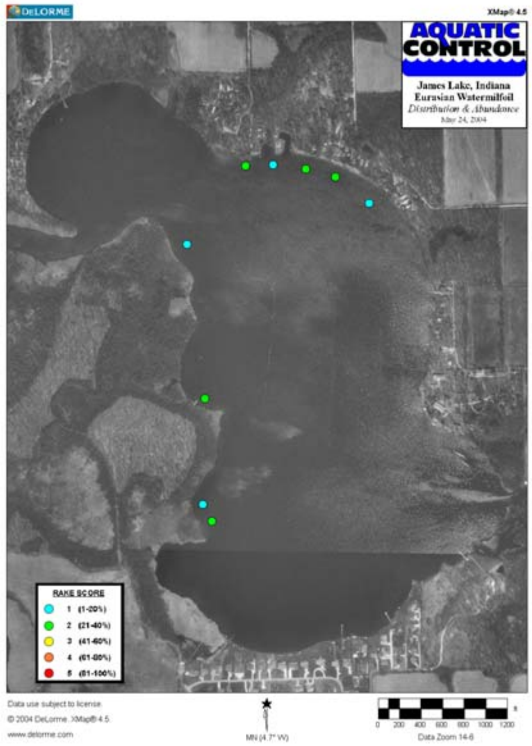

Figure 22. James Lake, Eurasian watermilfoil abundance and distribution and abundance, May 24, 2004 (not to scale see appendix)

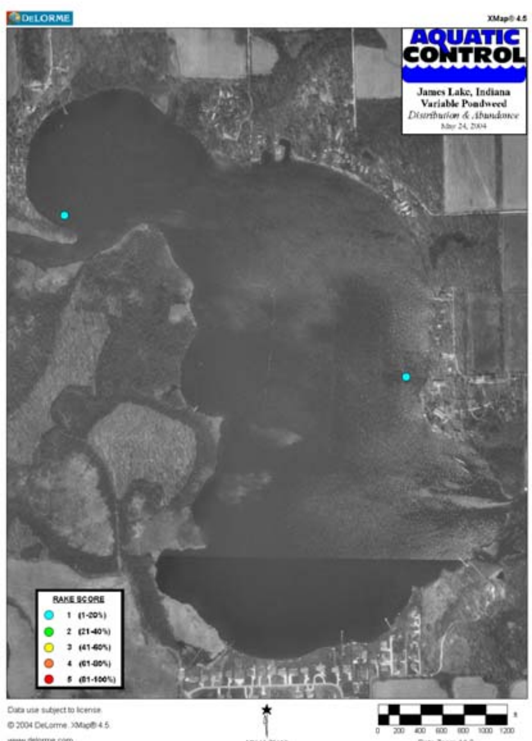

Figure 23. James Lake, variable pondweed abundance and distribution and abundance, May 24, 2004 (not to scale see appendix)

August Tier I and Tier II Surveys

On August 25 & 26, 2004 Tier I and II surveys were completed on Oswego, James, and Lake Tippecanoe. The Tier I survey was developed to serve as a qualitative surveying mechanism for aquatic plants. The Tier I survey is based upon the procedure manual developed by Shuler & Hoffmann, 2002. This survey will serve to meet the following objectives:

1. to provide a distribution map of the aquatic plant species within a waterbody
2. to document gross changes in the extent of a particular plant bed or the relative abundance of a species within a waterbody (IDNR, 2004)

Oswego-Tier I Survey

The Tier I survey revealed four distinct plant beds within Oswego Lake totaling 54.24 acres (Table 8 & Figure 24). Vegetation was present to a maximum depth of 18 feet. Thirteen different species were observed. Plant beds varied widely in size and species diversity.

Table 8. Oswego Lake Tier I Survey Results, August 25, 2004

Plant Bed I.D.	#1	#2	#3	#4
Plant Bed Size (acres)	2.90	18.67	8.67	24.00
	Rating*	Rating*	Rating*	Rating*
Eel grass	3	2	2	2
Chara	2	1	2	3
Coontail	3	2	2	2
Eurasian watermilfoil	1	-	2	-
Sago pondweed	1	-	1	1
White water lily	-	1	1	1
Lotus species**	-	-	1	-
Richardson's pondweed	1	-	-	1
Spatterdock	-	-	1	-
Variable pondweed	-	-	-	1
Whorled watermilfoil	-	1	-	-
Illinois pondweed	1	-	-	-
Curlyleaf pondweed	-	1	-	-

*Rating based on score of 1-4 with 1 being least dense and 4 being most dense
**Initially identified as American lotus, but may be an introduced exotic form

Figure 24. Tier I Plant Beds, Oswego Lake, August 25, 2004 (not to scale see appendix)

Plant bed 1 was located along the eastern side of the only island in Oswego Lake (Figure 24). It was determined to be 2.9 acres in size. The substrate of plant bed 1 was predominantly sand. A total of 7 species were observed within the plant bed. Coontail and eel grass were the dominant plant species (21-60% abundance rating). Chara was present at a 2-20% abundance rating. Eurasian watermilfoil, Richardson's pondweed (*Potamogeton richardsonii*), sago pondweed, and Illinois pondweed (*Potamogeton illinoensis*) were present at the lowest abundance rating (less than 2%). This area has historically been dominated by Eurasian watermilfoil, but during 2004 a triclopyr herbicide treatment was completed to selectively control this species.

Plant bed 2 was located on the western side and southern side of the island and included the shoreline area along the northwest side of Oswego Lake. This plant bed was determined to be 18.67 acres (Figure 24). The substrate of plant bed 2 was sand. A total of 6 species were observed within the plant bed. Eel grass and coontail were the dominant species (2-20% abundance rating). Chara, whorled watermilfoil (*Myriophyllum verticillatum*), white water lily (*Nymphaea odorata*), and curlyleaf pondweed were present at the lowest abundance rating (less than 2%). This area was dominated by Eurasian watermilfoil in the spring, but a treatment was completed in late May with triclopyr herbicide. No Eurasian watermilfoil was sampled from this area in August.

Plant bed 3 was located south of plant bed 3 in the southwest corner of Oswego Lake. This plant bed was determined to be 8.67 acres (Figure 24). The substrate of plant bed 3 was sand. A total of 8 species were observed within the plant bed. Chara, eel grass, Eurasian watermilfoil, and coontail were present at 2-20% abundance. Sago pondweed, spatterdock (*Nuphar spp.*), lotus (*Nelumbo spp.*), and white water lily were also observed. The species of lotus observed was initially identified as American lotus, but based on conversations with colleagues may be an introduced exotic species. A sample of this species should be sent off for positive identification.

Plant bed 4 encompassed the entire eastern shore of Oswego Lake (Figure 24). This plant bed was determined to be 24.0 acres. The substrate of plant bed 4 was sand. A total of 7 species were observed within the plant bed. Chara was the most abundant species observed (21-60% abundance rating). Eel grass and coontail were observed at 2-20% abundance. White water lily, Richardson's pondweed, , variable pondweed, and sago pondweed were present at less than 2% abundance.

Oswego Lake, August Tier II Survey Results
Tier II sampling took place on August 25, 2004 immediately following the Tier I sampling. A Secchi disk reading was taken prior to sampling and was found to be 6 feet. Plants were present to a maximum depth of 18 feet. Forty sites were randomly selected within the littoral zone (the number of sites selected is based on lake size and illustrated in Figure 25). The mean rake density score for Oswego Lake was 3.30. Species richness (average number of species per site) was 1.88 for all species and 1.70 for natives only. Site species diversity index was 0.84 for all species and 0.81 for native species only. Oswego Lake had a rake diversity score of 0.77 for all species and 0.75 for natives only (Table 9). Aquatic vegetation distribution and density is illustrated in Figure 26.

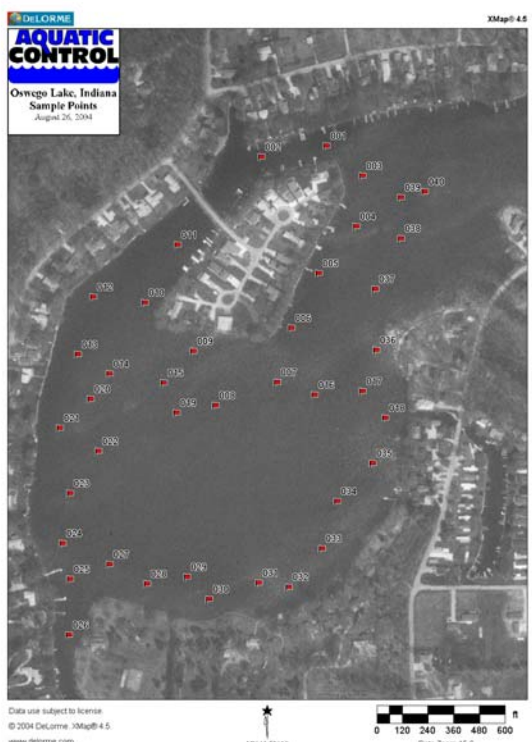

Figure 25. Oswego Lake Tier II Sample Points, August, 25, 2004 (not to scale see appendix)

Table 9. August 25, 2004 Oswego Lake vegetation abundance, density, and diversity metrics compared to May 24, 2004.

	Oswego Lake August*	Oswego Lake May*
Percentage of sample sites with vegetation	95%	97%
# of species collected	12	8
# of native species collected	10	6
Mean Rake Density	3.30	2.58
Rake Diversity (SDI)	0.77	0.77
Native Rake Diversity (SDI)	0.75	0.63
Species Richness (Avg # spec./site)	1.88	1.88
Native Species Richness	1.70	1.09
Site Species Diversity	0.84	0.79
Site Species native diversity	0.81	0.66

*standard deviation not included

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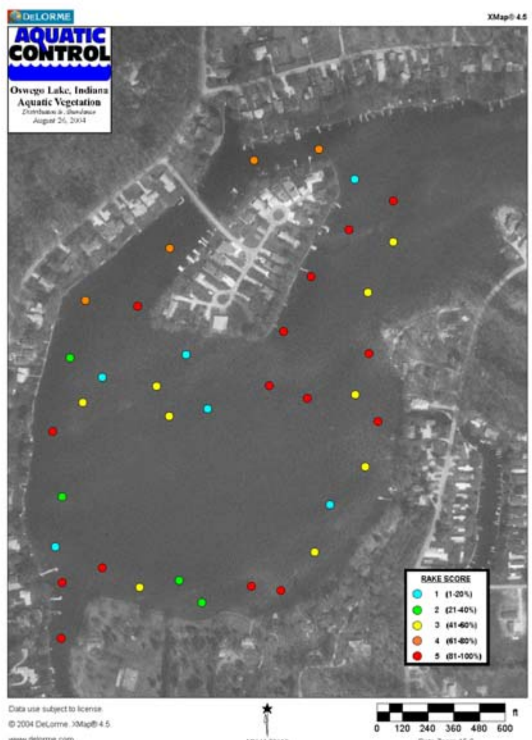

Figure 26. Oswego Lake, aquatic vegetation distribution and abundance, August 25, 2004 (not to scale see appendix)

Table 10 illustrates the frequency of occurrence, relative density, and dominance index of individual species collected from Oswego Lake. A total of 12 species were collected of which 10 of the species were natives (Table 10). Eurasian watermilfoil, spiny naiad, and curlyleaf pondweed were the exotic species collected. Coontail was present at the highest percentage of sample sites (50.0%) (Figure 27), followed by eel grass (37.5%) (Figure 28), chara (35.0%), sago pondweed (17.5%) (Figure 29), Eurasian watermilfoil (10.0%)

(Figure 30), slender naiad (7.5%), and curlyleaf pondweed (7.5%) (Figure 31). Illinois pondweed, spiny naiad (*Najas marina*) (Figure 32), Richardson's pondweed, and flat-stemmed pondweed were present at 5% of sampling sites. American elodea was present at only one site (2.5%).

Table 10. Oswego Lake, species collected during Tier II sampling, August 25, 2004

Common Name	Scientific Name	Frequency of Occurrence	Relative Density*	Dominance Index**
Coontail	*Ceratophyllum demersum*	50.0%	1.35	27.0
Eel grass	*Vallisneria americana*	37.5%	1.03	20.5
Chara	*Chara spp.*	35.0%	0.83	16.5
Sago pondweed	*Potamogeton pectinatus*	17.5%	0.30	6.0
Eurasian watermilfoil	*Myriophyllum spicatum*	10.0%	0.10	2.0
Slender naiad	*Najas flexilis*	7.5%	0.10	2.0
Curlyleaf pondweed	*Potamogeton crispus*	7.5%	0.08	1.5
Illinois pondweed	*Potamogeton illinoensis*	5.0%	0.05	1.0
Richardson's pondweed	*Potamogeton richardsonii*	5.0%	0.08	1.5
Flatstem pondweed	*Potamogeton zosteriformis*	5.0%	0.05	1.0
Spiny naiad	*Najas marina*	5.0%	0.05	1.0
American elodea	*Elodea canadensis*	2.5%	0.03	0.5

*Mean rake score at all sites
**Percent of Maximum Abundance

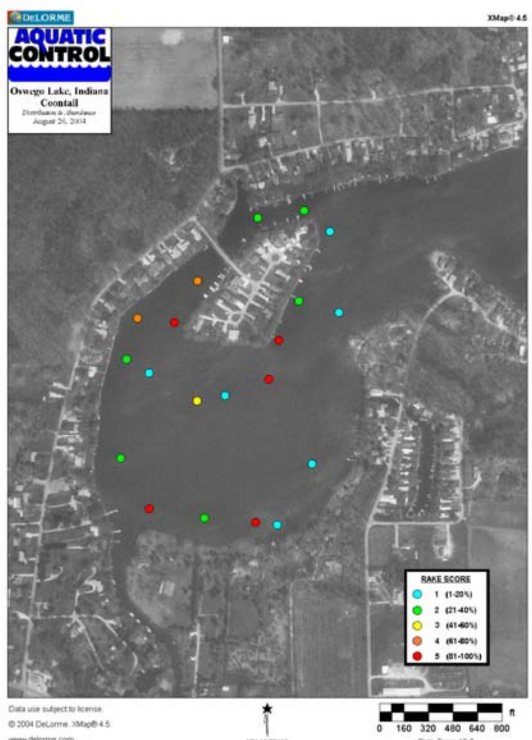

Figure 27. Oswego Lake, coontail distribution and abundance, August 25, 2004 (not to scale see appendix)

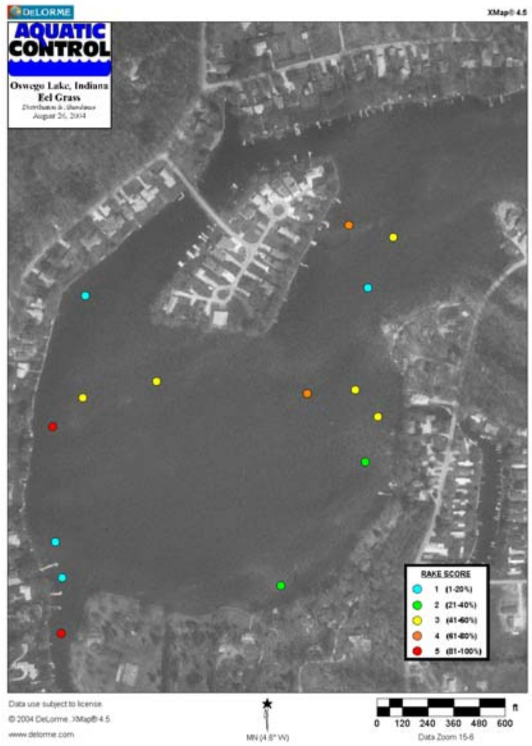

Figure 28. Oswego Lake, eel grass distribution and abundance, August 25, 2004 (not to scale see appendix)

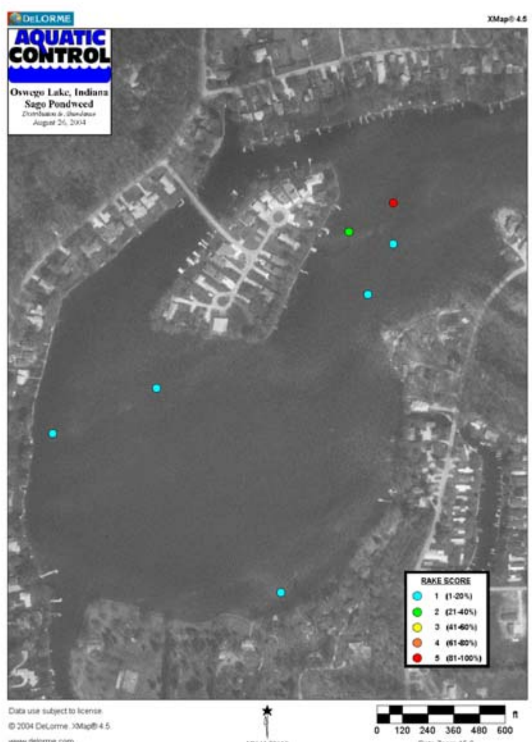

Figure 29. Oswego Lake, sago pondweed distribution and abundance, August 25, 2004 (not to scale see appendix)

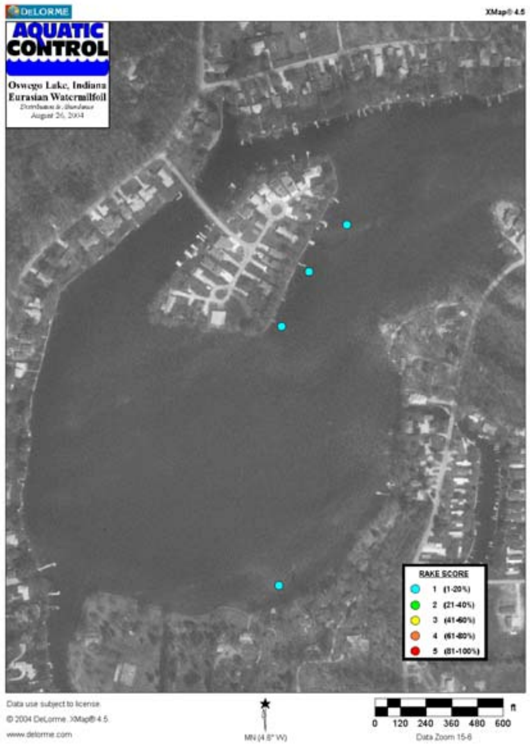

Figure 30. Oswego Lake, Eurasian watermilfoil distribution and abundance, August 25, 2004 (not to scale see appendix)

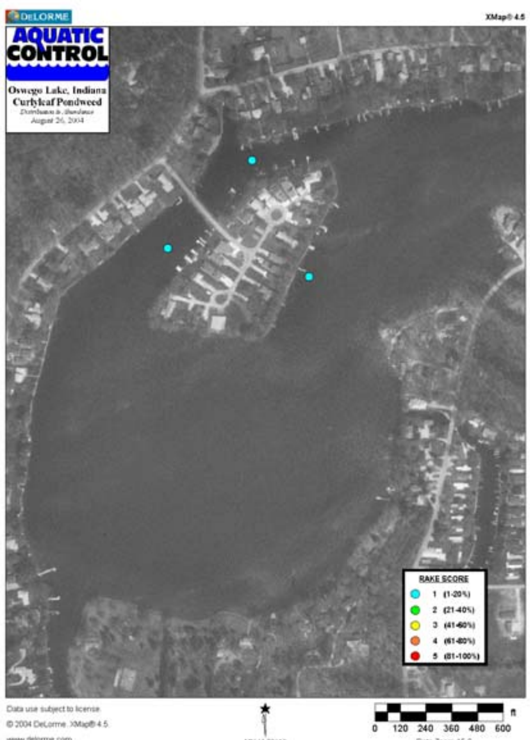

Figure 31. Oswego Lake, curlyleaf pondweed distribution and abundance, August 25, 2004 (not to scale see appendix)

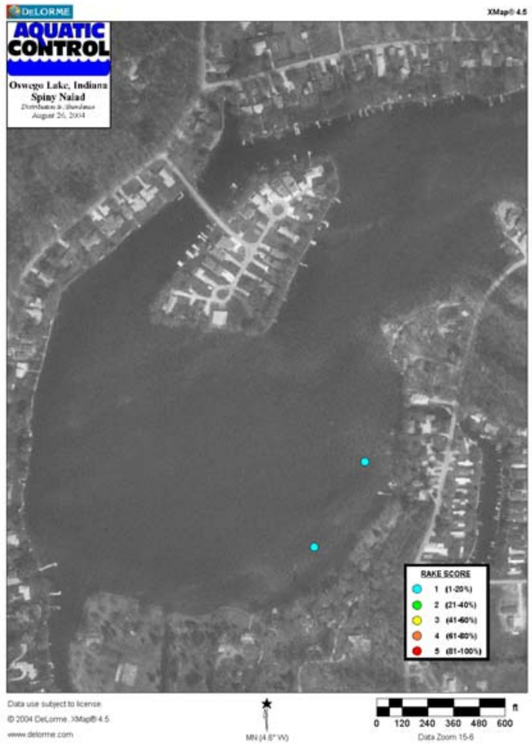

Figure 32. Oswego Lake, spiny naiad distribution and abundance, August 25, 2004 (not to scale see appendix)

Lake Tippecanoe -Tier I Survey

The Tier I survey revealed five distinct plant beds within Lake Tippecanoe totaling 394 acres. (Table 11 & Figure 33). Vegetation was present to a maximum depth of 19 feet. Twelve different species were observed. Plant beds varied widely in size and species diversity.

Table 11. Lake Tippecanoe Tier I Survey Results, August 25, 2004

Plant Bed I.D.	#1	#2	#3	#4	#5
Plant Bed Size (acres)	125.30	57.98	44.25	33.19	67.31
	Rating*	Rating*	Rating*	Rating*	Rating*
Eel grass	3	3	4	3	2
Chara	2	2	1	1	2
Coontail	2	2	1	-	-
Eurasian watermilfoil	1	3	1	1	1
Sago pondweed	2	1	1	2	2
White water lily	1	-	-	-	1
Richardson's pondweed	1	1	1	2	2
Spatterdock	1	1	-	-	1
Variable pondweed	1	1	1	1	1
Illinois pondweed	1	-	1	2	1
Curlyleaf pondweed	1	-	-	1	1
Flatstem pondweed	-	-	-	1	1

*Rating based on score of 1-4 with 1 being least dense and 4 being most dense

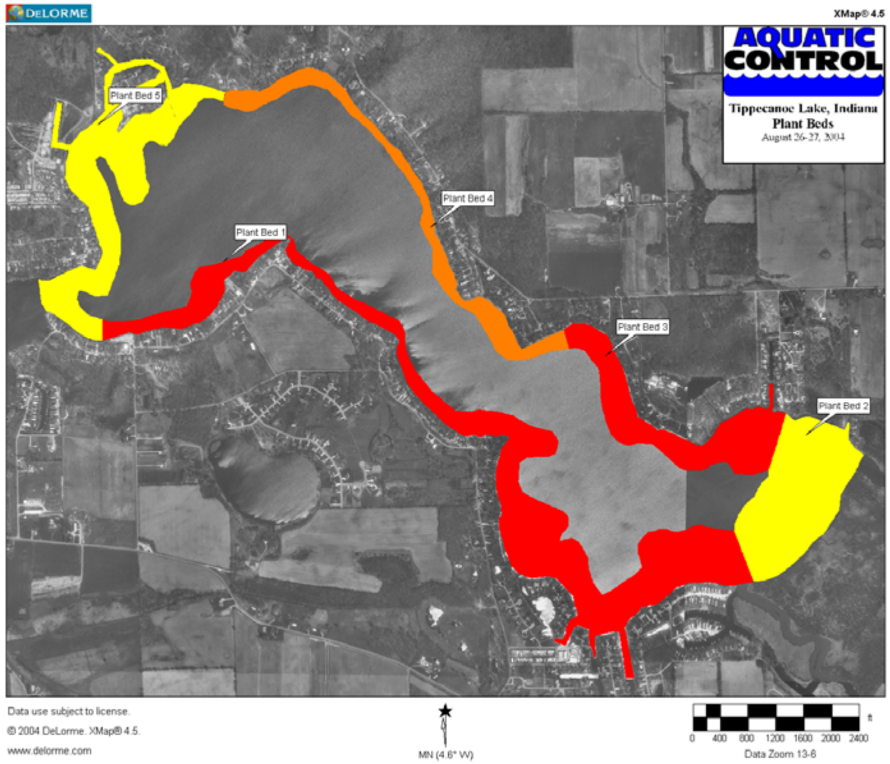

Figure 33. Tier I Plant Beds, Lake Tippecanoe, August 25, 2004 (not to scale see appendix)

Plant bed 1 encompassed the southern shoreline of Lake Tippecanoe (Figure 33). It was determined to be 67.31 acres in size. The substrate of plant bed 1 was predominantly sand. A total of 11 species were observed within the plant bed. Eel grass was the dominant plant species (21-60% abundance rating). Chara, coontail, and sago pondweed were present at a 2-20% abundance rating. Eurasian watermilfoil, Richardson's pondweed, curlyleaf pondweed, variable pondweed, spatterdock, white water lily, and Illinois pondweed were present at the lowest abundance rating (less than 2%).

Plant bed 2 was located in the eastern section of Lake Tippecanoe and encompassed 57.98 acres (Figure 33). The substrate of plant bed 2 was sand. A total of 8 species were observed within the plant bed. Eurasian watermilfoil and eel grass were the dominant species (21-60% abundance rating). Chara and coontail were present at 2-20% abundance. Sago pondweed, Richardson's pondweed, variable pondweed, and spatterdock were also observed (less than 2% abundance rating).

Plant bed 3 was located west of plant bed 2 and was determined to be 44.25 acres (Figure 33). The substrate of plant bed 3 was sand. A total of 8 species were observed within the plant bed. Eel grass was the most abundant species (>60%). Chara, Eurasian watermilfoil, Illinois pondweed, sago pondweed, Richardson's pondweed, variable pondweed, and coontail were present at less than 2% abundance.

Plant bed 4 was located west of plant bed 3 along the northern shore of Tippecanoe Lake (Figure 33). This bed was determined to be 33.19 acres. The substrate of plant bed 4 was sand. A total of 9 species were observed within the plant bed. Eel grass was the most abundant species observed (21-60% abundance rating). Illinois pondweed, sago pondweed, and Richardson's pondweed were observed at 2-20% abundance. Eurasian watermilfoil, chara, curlyleaf pondweed, flatstem pondweed, and variable pondweed were present at less than 2% abundance.

Plant bed 5 was located on the western shore of Lake Tippecanoe and comprised 67.31 acres (Figure 33). The substrate of plant bed 5 was sand. A total of 11 species were observed within the plant bed. Chara, eel grass, sago pondweed, and Richardson's pondweed were the dominant species (2-20% abundance). Eurasian watermilfoil, curlyleaf pondweed, Illinois pondweed, flatstem pondweed, variable pondweed, white water lily, and spatterdock were observed at less than 2% abundance.

Lake Tippecanoe Tier II Survey Results

Tier II sampling took place on August 25, 2004 immediately following the Tier I sampling. A Secchi disk reading was taken prior to sampling and was found to be 6 feet. Plants were present to a maximum depth of 19 feet. One-hundred and nineteen sites were randomly selected within the littoral zone (the number of sites selected is based on lake size and are illustrated in Figure 34). A total of 12 species were collected of which 10 of the species were natives. The mean rake density score for Lake Tippecanoe was 2.71. Species richness (average number of species per site) was 1.76 for all species and 1.54 for natives only. Site species diversity index was 0.82 for all species and 0.78 for native species only. Lake Tippecanoe had a rake diversity score of 0.70 for all species and 0.65 for natives only (Table 12). Submersed vegetation distribution and density is illustrated in Figure 35.

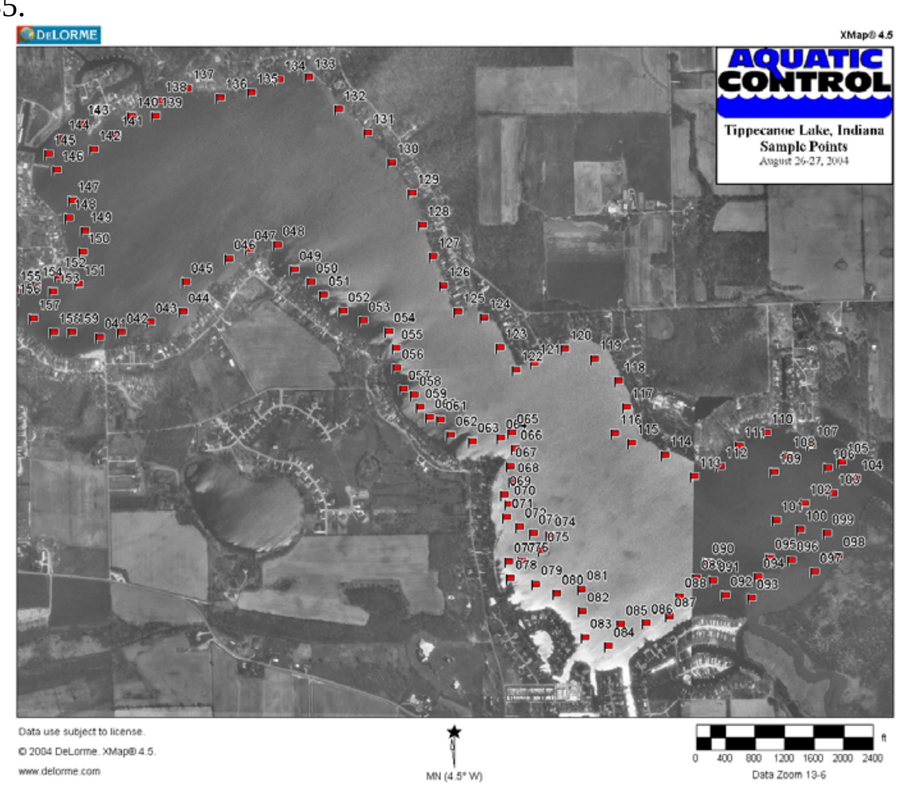

Figure 34. Lake Tippecanoe August 25, 2004 sampling points

Table 12. August 25, 2004 Lake Tippecanoe vegetation abundance, density, and diversity metrics compared to My 24, 2004.

	Lake Tippecanoe Summer*	Lake Tippecanoe Spring*
Percentage of sample sites with vegetation	88%	89%
# of species collected	12	12
# of native species collected	10	10
Mean Rake Density	2.71	2.26
Rake Diversity (SDI)	0.70	0.78
Native Rake Diversity (SDI)	0.65	0.74
Species Richness (Avg # spec./site)	1.76	1.66
Native Species Richness	1.54	0.97
Site Species Diversity	0.82	0.83
Site Species native diversity	0.78	0.79

*standard deviation not included

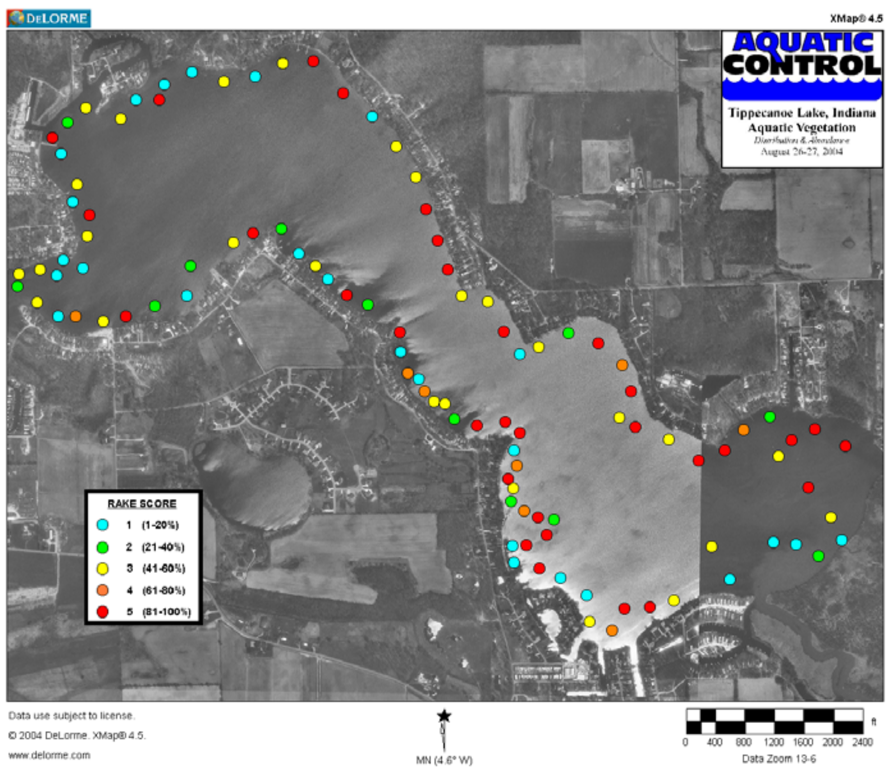

Figure 35. Lake Tippecanoe, aquatic vegetation distribution and abundance, August 25, 2004 (not to scale see appendix)

Table 13 illustrates frequency of occurrence, relative density, and the dominance index of individual species collected from Lake Tippecanoe. Eurasian watermilfoil and curlyleaf pondweed were the exotic species collected. Eel grass was present at the highest percentage of sample sites (61.3%) (Figure 36), followed by coontail (26.1%) (Figure 37), chara (23.5%), Eurasian watermilfoil (19.3%) (Figure 38), sago pondweed (10.9%) (Figure 39), Richardson's pondweed (9.2%), flatstem pondweed (6.7%), slender naiad

(5.9%), water stargrass (5.0%), curlyleaf pondweed (3.4%) (Figure 40), variable pondweed (3.4%), and Illinois pondweed (1.7%).

Table 13. Lake Tippecanoe species collected during Tier II sampling, August 25, 2004.

Common Name	Scientific Name	Frequency of Occurrence	Relative Density*	Dominance Index**
Eel grass	*Vallisneria americana*	61.3%	1.76	35.1
Coontail	*Ceratophyllum demersum*	26.1%	0.53	10.6
Chara	*Chara spp.*	23.5%	0.35	7.1
Eurasian watermilfoil	*Myriophyllum spicatum*	19.3%	0.26	5.2
Sago pondweed	*Potamogeton pectinatus*	10.9%	0.20	4.0
Richardson's pondweed	*Potamogeton richardsonii*	9.2%	0.09	1.8
Flatstem pondweed	*Potamogeton zosteriformis*	6.7%	0.07	1.3
Slender naiad	*Najas flexilis*	5.9%	0.07	1.3
Water stargrass	*Zosterella dubia*	5.0%	0.08	1.7
Curlyleaf pondweed	*Potamogeton crispus*	3.4%	0.03	0.7
Variable pondweed	*Potamogeton gramineus*	3.4%	0.03	0.8
Illinois pondweed	*Potamogeton illinoensis*	1.7%	0.02	0.3

*Mean rake score at all sites
**Percent of Maximum Abundance

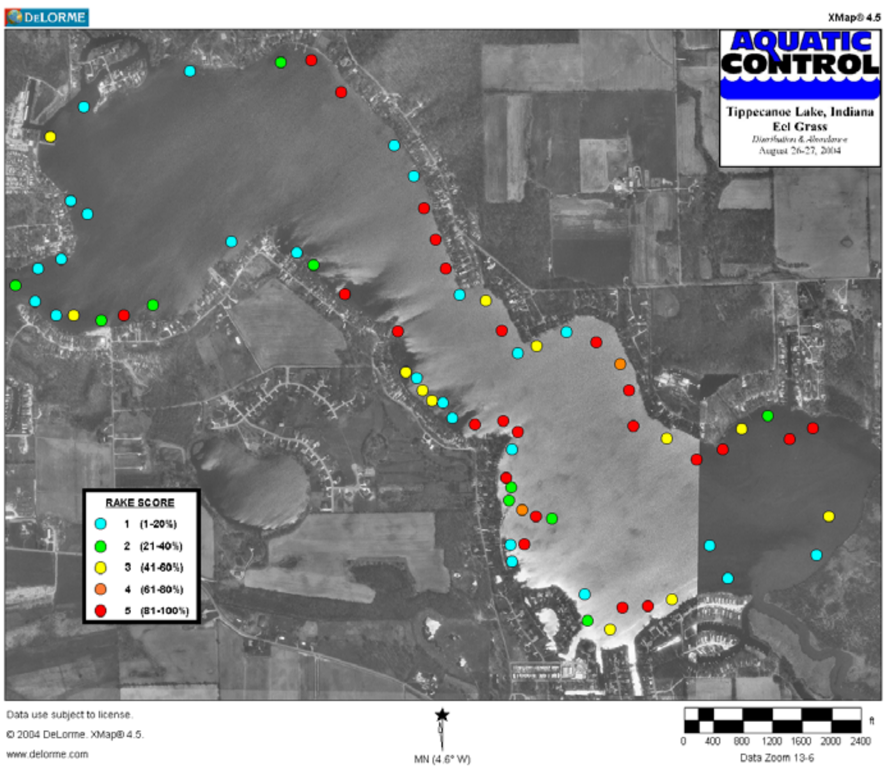

Figure 36. Lake Tippecanoe, eel grass distribution and abundance, August 25, 2004 (not to scale see appendix)

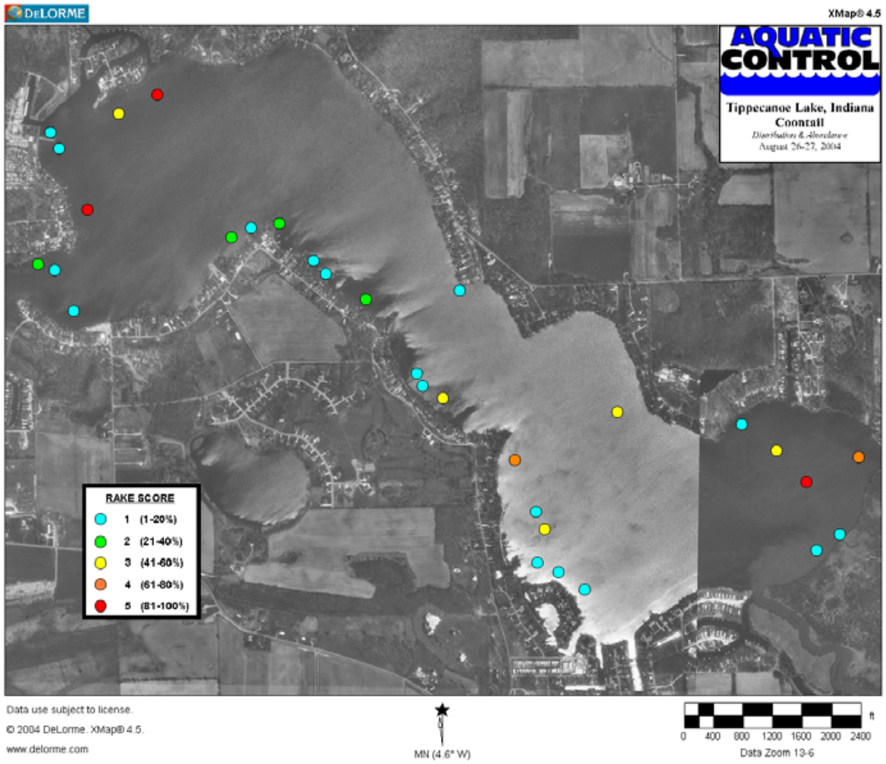

Figure 37. Lake Tippecanoe, coontail distribution and abundance, August 25, 2004 (not to scale see appendix)

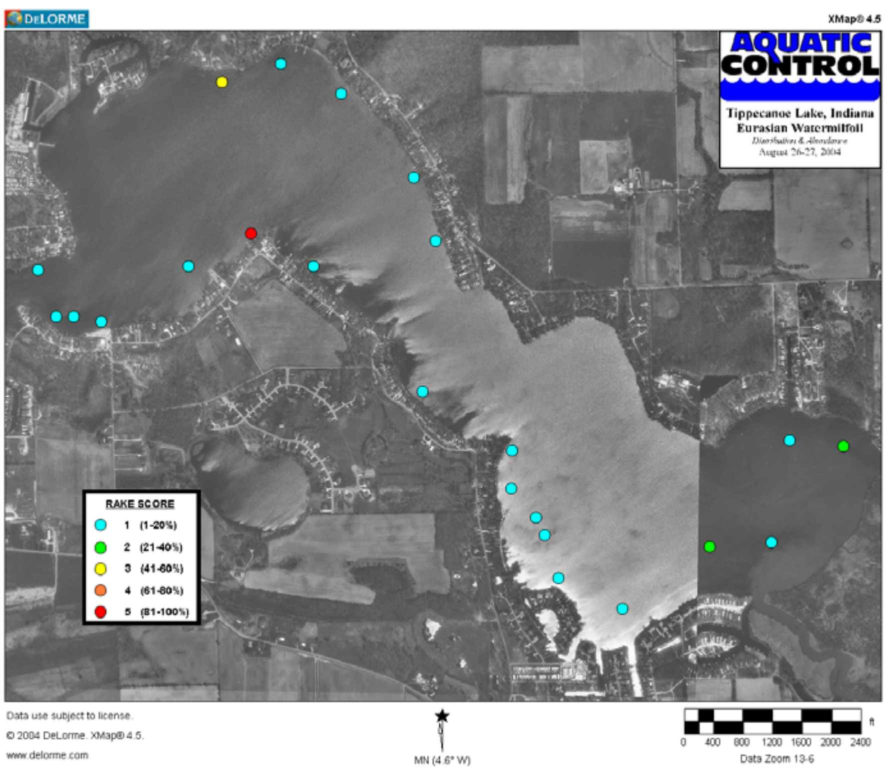

Figure 38. Lake Tippecanoe, Eurasian watermilfoil distribution and abundance, August 25, 2004 (not to scale see appendix)

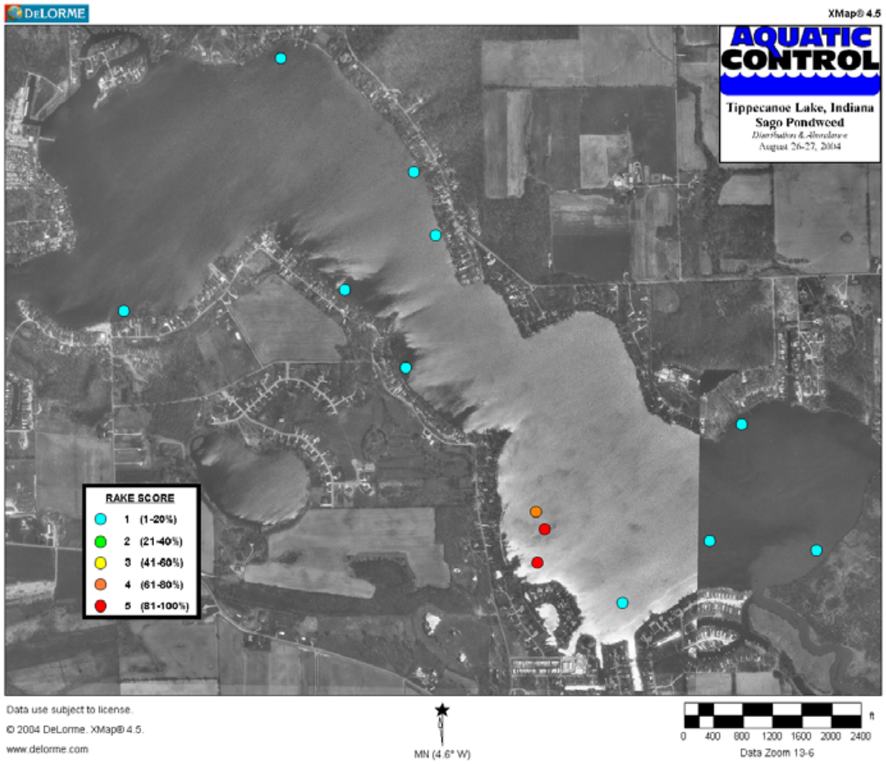

Figure 39. Lake Tippecanoe, sago pondweed distribution and abundance, August 25, 2004 (not to scale see appendix)

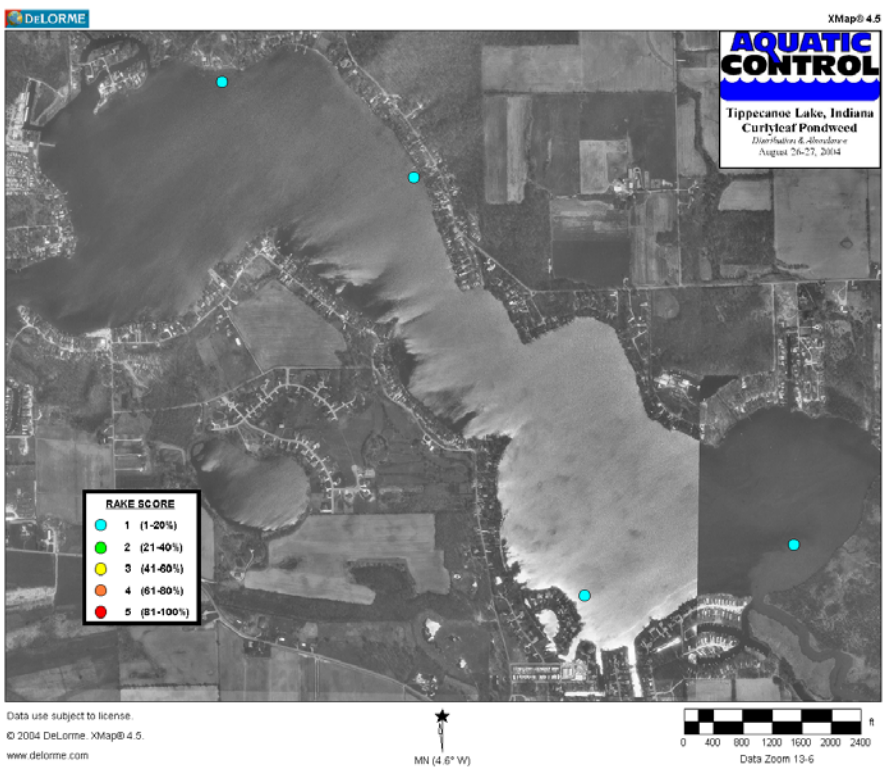

Figure 40. Lake Tippecanoe, curlyleaf pondweed distribution and abundance, August 25, 2004 (not to scale see appendix)

James Lake -Tier I Survey

The Tier I survey revealed only one distinct plant bed within James Lake totaling 120.7 acres. (Table 14 and Figure 41). Vegetation was present to a maximum depth of 20 feet. Thirteen different species were observed. Aquatic vegetation diversity, density, and abundance was fairly consistent throughout the littoral zone.

Table 14. James Lake, Tier I Survey Results, August 26, 2004

Plant Bed I.D.	#1
Plant Bed Size (acres)	120.78
	Rating*
Eel grass	3
Chara	2
Eurasian watermilfoil	2
Coontail	1
Sago pondweed	1
White water lily	1
Richardson's pondweed	1
Spatterdock	1
Variable pondweed	1
Illinois pondweed	1
American pondweed	1
Largeleaf pondweed	1
Slender naiad	1

Figure 41. Tier I Plant Beds, James Lake, August 26, 2004 (not to scale see appendix)

Plant bed 1 was determined to be 120.7 acres in size. The substrate of plant bed 1 was predominantly sand. A total of 11 species were observed within the plant bed. Eel grass was the dominant plant species (21-60% abundance rating). Chara and Eurasian watermilfoil were present at a 2-20% abundance rating. Coontail, slender naiad, variable pondweed, Illinois pondweed, sago pondweed, Richardson's pondweed, spatterdock, white water lily, American pondweed, and largeleaf pondweed were present at the lowest abundance rating (less than 2%).

James Lake Tier II Survey

Tier II sampling took place on August 26, 2004 immediately following the Tier I sampling. A Secchi disk reading was taken prior to sampling and was found to be 6 feet. Plants were present to a maximum depth of 20 feet. Sixty-four sites were randomly selected within the littoral zone (the number of sites selected is based on lake size, see Figure 42). The mean rake density score for James Lake was 3.50. Species richness (average number of species per site) was 2.23 for all species and 1.91 for natives only. Site species diversity index was 0.85 for all species and 0.82 for native species only. James Lake had a rake diversity score of 0.78 for all species and 0.75 for natives only (Table 15). James Lake appears to have a dense and diverse native plant population, however; Eurasian watermilfoil was present at a higher percentage of sites than in the spring survey. This may be due to the lack of selective milfoil treatments which were not completed on this lake.

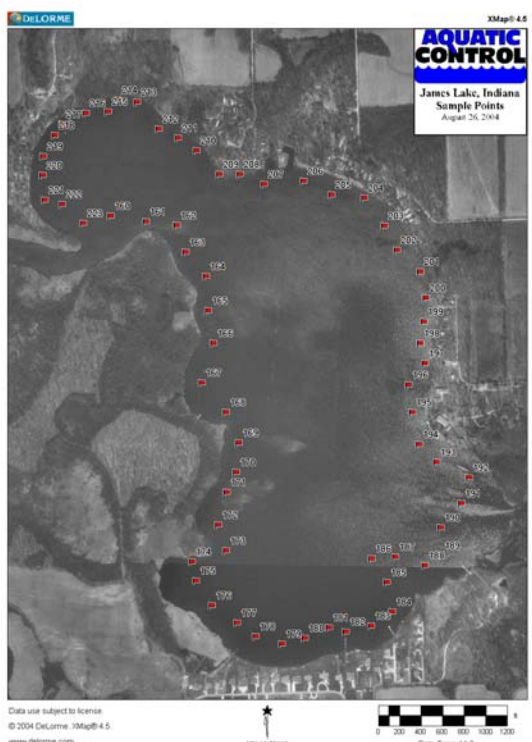

Figure 42. James Lake, August 26, 2004 sampling points

Table 15. August 26, 2004, James Lake vegetation abundance, density, and diversity metrics compared to May 24, 2004.

	James Lake Summer*	James Lake Spring*
Percentage of sample sites with vegetation	96%	90%
# of species collected	14	11
# of native species collected	11	9
Mean Rake Density	3.50	2.47
Rake Diversity (SDI)	0.78	0.76
Native Rake Diversity (SDI)	0.75	0.65
Species Richness (Avg # spec./site)	2.23	1.65
Native Species Richness	1.91	1.09
Site Species Diversity	0.85	0.80
Site Species native diversity	0.82	0.71

*standard deviation not included
**average calculated from Pearson Data.

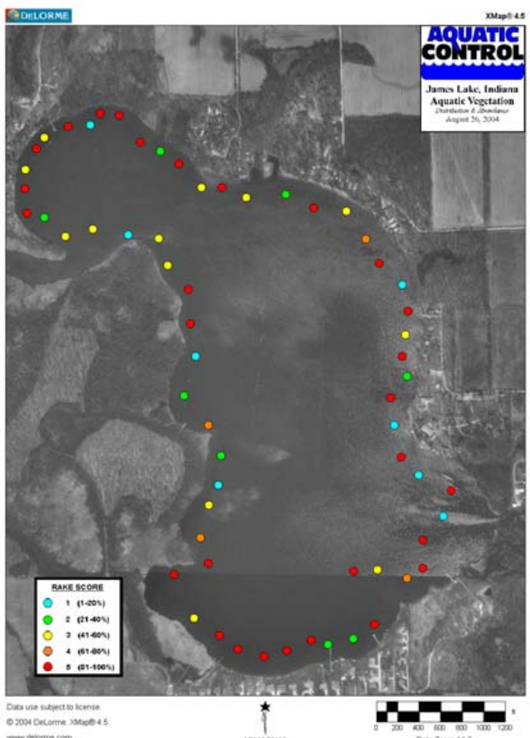

Figure 43. James Lake, aquatic vegetation distribution and abundance, August 26, 2004 (not to scale see appendix)

A total of 14 species were collected of which 12 of the species were natives. Eurasian watermilfoil and curlyleaf pondweed were the exotic species collected (Table 16). Coontail was present at the highest percentage of sample sites (57.8%) (Figure 44), followed by eel grass (42.2%) (Figure 45), chara (35.9%) (Figure 46), Eurasian watermilfoil (23.4%) (Figure 47), slender naiad (15.6%), curlyleaf pondweed (9.4%) (Figure 48), flat-stemmed pondweed (9.4%), water stargrass (6.3%), variable pondweed

(6.3%), sago pondweed (6.3%), American elodea (4.7%), leafy pondweed (3.1%), spiny naiad (1.6%), and common bladderwort (1.6%).

Table 16. James Lake, species collected during Tier II sampling, August 26, 2004.

Common Name	Scientific Name	Frequency of Occurrence	Relative Density*	Dominance Index**
Coontail	*Ceratophyllum demersum*	57.8%	1.72	34.4
Eel grass	*Vallisneria americana*	42.2%	1.05	20.9
Chara	*Chara spp.*	35.9%	0.66	13.1
Eurasian watermilfoil	*Myriophyllum spicatum*	23.4%	0.27	5.3
Slender naiad	*Najas flexilis*	15.6%	0.30	5.9
Curlyleaf pondweed	*Potamogeton crispus*	9.4%	0.11	2.2
Flat-stemmed pondweed	*Potamogeton zosteriformis*	9.4%	0.09	1.9
Water stargrass	*Zosterella dubia*	6.3%	0.08	1.6
Variable pondweed	*Potamogeton gramineus*	6.3%	0.06	1.3
Sago pondweed	*Potamogeton pectinatus*	6.3%	0.08	1.6
American elodea	*Elodea canadensis*	4.7%	0.08	1.6
Leafy pondweed	*Potamogeton foliosus*	3.1%	0.06	1.3
Spiny naiad	*Najas marina*	1.6%	0.02	0.3
Common bladderwort	*Utricularia vulgaris*	1.6%	0.02	0.3

*Mean rake score at all sites

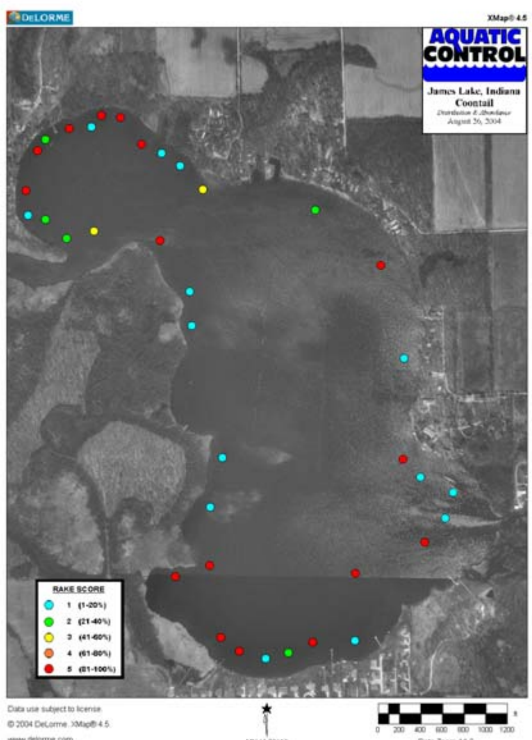

Figure 44. James Lake, coontail distribution and abundance, August 26, 2004 (not to scale see appendix)

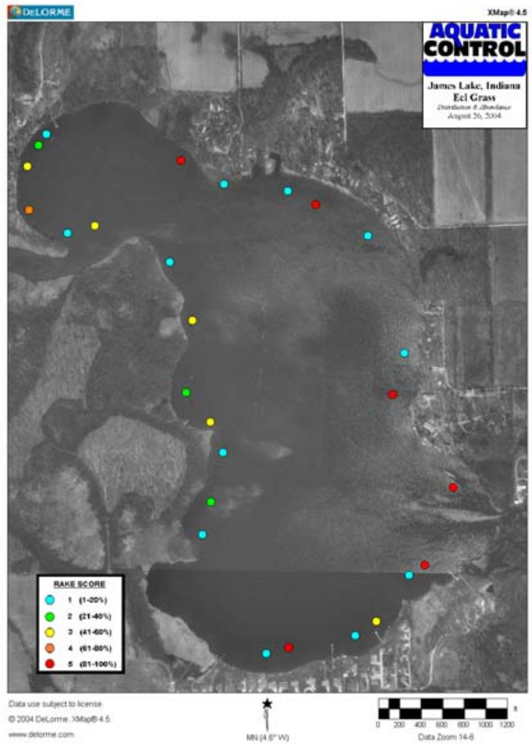

Figure 45. James Lake, eel grass distribution and abundance, August 26, 2004 (not to scale see appendix)

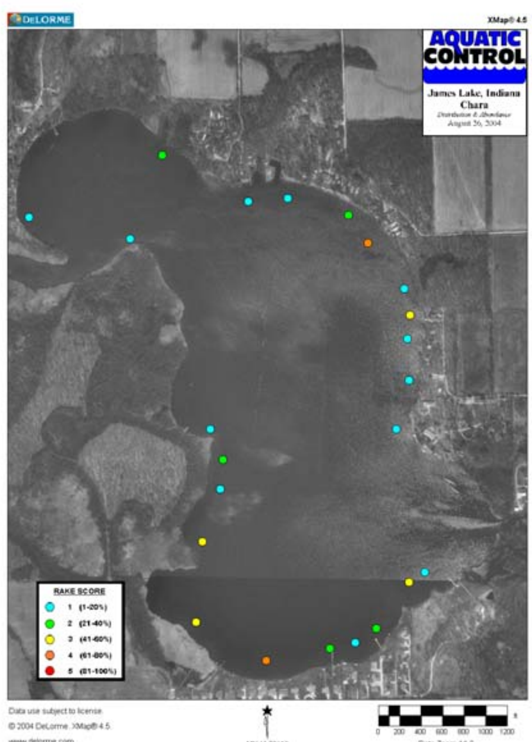

Figure 46. James Lake, chara distribution and abundance, August 26, 2004 (not to scale see appendix)

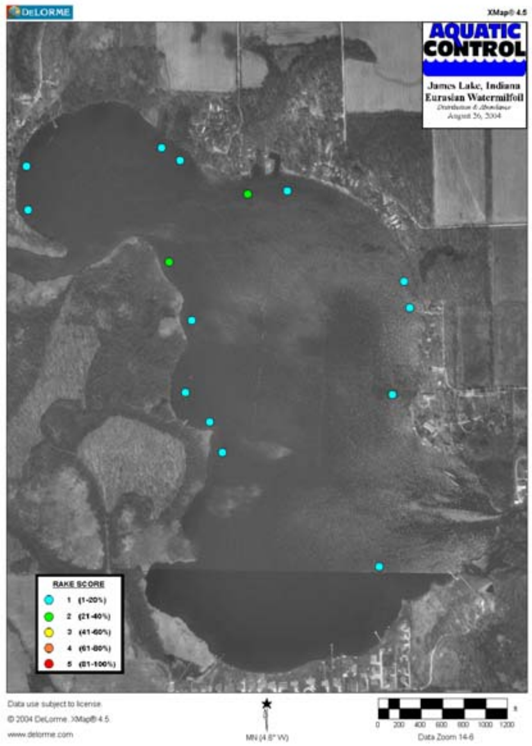

Figure 47. James Lake, Eurasian watermilfoil distribution and abundance, August 26, 2004 (not to scale see appendix)

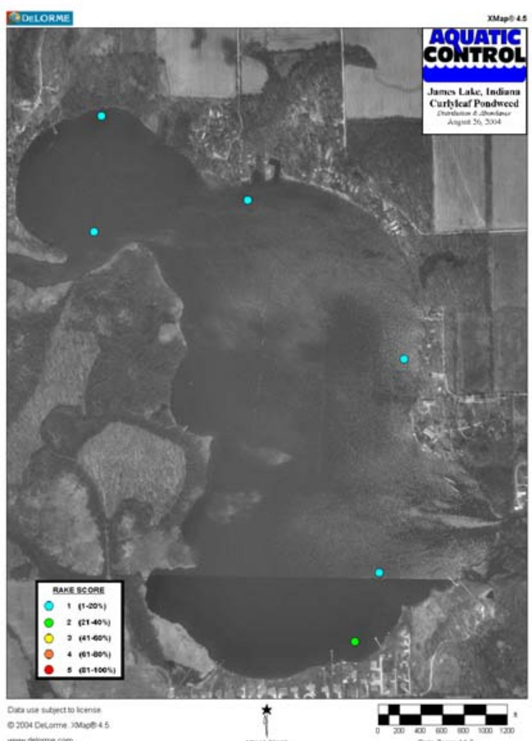

Figure 48. James Lake, curlyleaf pondweed distribution and abundance, August 26, 2004 (not to scale see appendix)

Plant Sampling Discussion
The plant sampling completed in 2004 provides a valuable dataset. The May and August sampling allows for comparison of the submersed vegetation community at different times of the year. This dataset also allows for the comparison of the plant community prior to and following selective vegetation control efforts. The initial sampling was completed one day prior to herbicide application on Oswego and Lake Tippecanoe. This application targeted Eurasian watermilfoil and curlyleaf pondweed. Twenty percent of the littoral zone was treated on Oswego Lake and five percent on Lake Tippecanoe (this treatment will be further discussed in the Plant Management History section of this report).

Oswego Lake received the most intense herbicide application due to the nuisance conditions caused by dense beds of Eurasian watermilfoil. The May/August comparison between Tier II surveys showed an increase in several metrics including the number of species collected, mean rake density, and native species richness (Table 9). The frequency of occurrence of Eurasian watermilfoil decreased from 51.5 to 10.0 percent and the relative density dropped from 1.12 to 0.10. Curlyleaf pondweed abundance and density also significantly decreased, but this decrease could be attributed to curlyleaf pondweed life cycle. Frequency of occurrence of coontail dropped slightly from 57.6% to 50%, but relative density increased from 0.79 to 1.35. The frequency of occurrence of eel grass increased from 12.1 to 37.5 percent and relative density increased from 0.12 to 1.03.

The comparison between the Lake Tippecanoe surveys showed slight increases in mean rake density and native species richness (Table 12). The same number of species was collected in both surveys. Eurasian watermifoil exhibited a slight decrease in relative density and frequency of occurrence. There was a significant decrease in frequency of occurrence (45.7% to 3.4%) and relative abundance (1.06 to 0.03%) of curlyleaf pondweed. Coontail and eel grass had the largest increases in frequency of occurrence and relative abundance.

James Lake had significant increases in mean rake density and native species richness. The number of species collected increased from 11 to 14 (Table 15). The frequency of occurrence of Eurasian watermilfoil increased from 12.2 to 23.4 percent. Relative density of this species also increased from 0.19 to 0.27. Curlyleaf pondweed decreased significantly in all categories. Frequency of occurrence and density of coontail and eel grass increased.

The comparison of the two surveys provides valuable information which can be used when making vegetation management decisions. All three lakes had increases in overall vegetation abundance and density. As expected, curlyleaf pondweed abundance and density dramatically decreased. Coontail either increased in abundance and density or remained at near the same level. Eel grass dramatically increased in all three lakes. In the lakes that received selective control treatments for Eurasian watermilfoil, there was a decrease in the frequency of occurrence and relative density of this species. Eurasian watermilfoil density and abundance increased in James Lake, which did not receive any large-scale selective control efforts.

Plant Management History

Historically, most aquatic vegetation management on the Lake Tippecanoe chain has been funded by individual homeowners and small channel associations. This makes tracking the plant management history of these lakes very difficult. The Lake Tippecanoe POA saw a need to better organize the plant management activity on these lakes and began work on a plant management program in 2002. The first step to administering this program was the completion of plant sampling in the late summer of 2002 and spring of 2003. Based upon recommendations from this sampling, a treatment program was initiated by the POA in the summer of 2003. The POA decided to take responsibility for main lake areas on Tippecanoe, James, and Oswego. Management of the man-made channels is currently left up to the individual homeowners and channel associations. The main focus of the POA has been on the control of exotic vegetation, primarily curlyleaf pondweed and Eurasian watermilfoil. In addition to the exotic vegetation, areas of native eel grass were also creating nuisance conditions in the late summer. Plans were formulated to apply selective herbicides in late spring and early summer for control of Eurasian watermilfoil and curlyleaf pondweed. In late summer, a treatment was also planned for control of nuisance areas of eel grass pending IDNR approval. On June 18, 2003, approximately 35 acres of Eurasian watermilfoil and curlyleaf pondweed was treated with triclopyr herbicide for selective control of Eurasian watermilfoil and a low dose of endothal herbicide for control of curlyleaf pondweed. Treatments took place on Lake Tippecanoe and Oswego Lake. The treatment areas were selected following the 2003 plant survey. Only the densest areas were treated due to a limited budget. Treatments were completed by Aquatic Control, Inc. No eel grass was treated in 2003 due to lack of approval from IDNR.

Following the May 2004 Tier II survey, another selective Eurasian watermilfoil/curlyleaf pondweed treatment was planned. On May 25, 2004, twenty-one acres of Eurasian watermilfoil and curlyleaf pondweed were treated on Lake Tippecanoe (Figure 49) and eleven acres were treated on Oswego Lake by Aquatic Control Inc (Figure 50). This treatment was considered very successful due to control of the exotic species and the presence of abundant native vegetation in the late summer surveys. Eurasian watermilfoil was present on James Lake, but wasn't treated due to a limited budget. IDNR surveyed the lake with Aquatic Control and Aquatic Weed Control in late summer to assess the need for an eel grass treatment. IDNR biologists agreed to allow 2.0 acres of eel grass to be treated on James Lake and 6 acres on Lake Tippecanoe (Figure 49 & 51). Only the densest beds of eel grass were treated in locations where this plant was interfering with lake usage, mainly boat access. This treatment was completed with a copper based herbicide (trade name Nautique). Both treatments were successful at reducing nuisance conditions. Figure 52 and 53 illustrate the conditions prior to and after herbicide application for control of Eurasian watermilfoil on Oswego Lake.

In addition to herbicide applications, the POA has stocked milfoil weevils in a small area located on the eastern side of Lake Tippecanoe. This stocking has met with limited success.

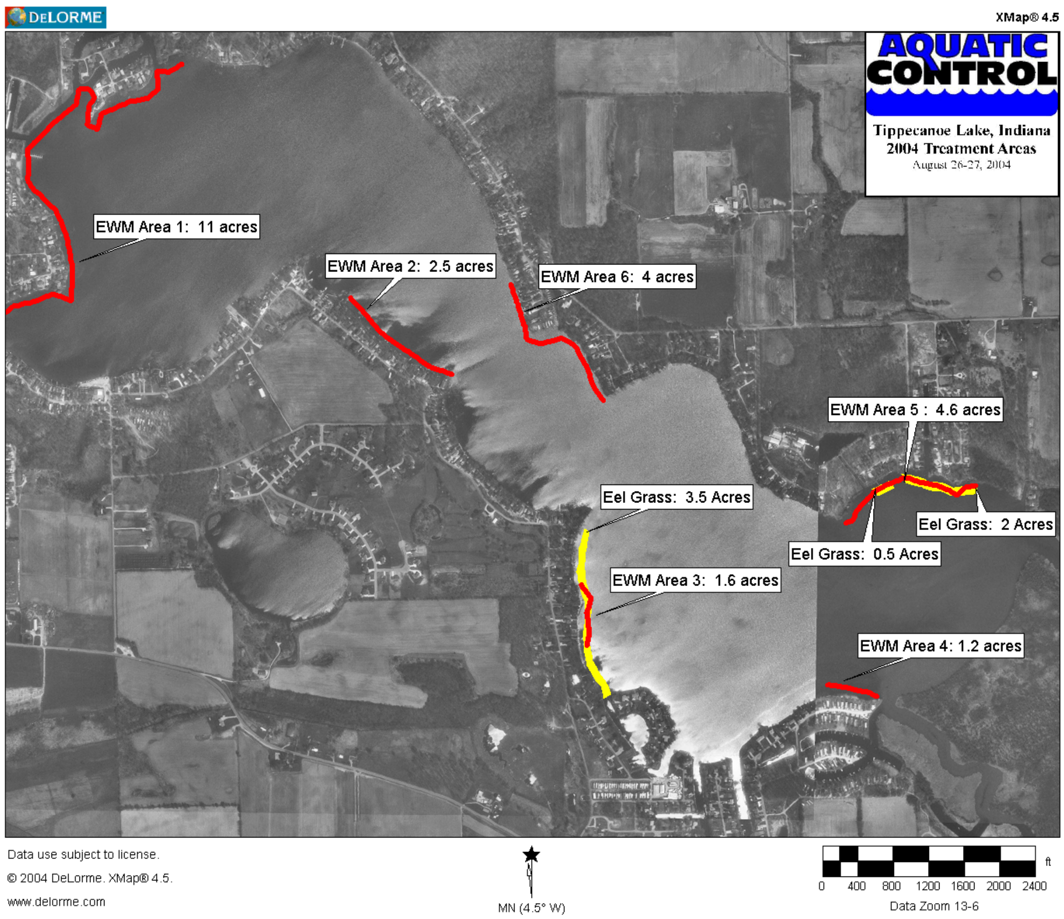

Figure 49. Lake Tippecanoe, 2004 eel grass, Eurasian watermilfoil, and curlyleaf pondweed treatments (not to scale see appendix)

Figure 50. Oswego Lake, Eurasian watermilfoil and curlyleaf pondweed treatment areas, May 25, 2004

Figure 51. James Lake, eel grass treatment areas, August 6, 2004

Figure 52. Oswego Lake, pre-treatment Eurasian watermilfoil bed, May 25, 2004.

Figure 53. Oswego Lake post treatment, June 24, 2004.

Aquatic Plant Management Alternatives

Two exotic species were found to be abundant in Lake Tippecanoe, Oswego, and James Lake during the 2004 sampling: Eurasian watermilfoil and curlyleaf pondweed. The 2004 sampling focused on submersed vegetation, but purple loosestrife (*Lythrum salicaria*), a wetland exotic species, has been observed in scattered locations around the lake.

Curlyleaf pondweed and Eurasian watermilfoil can create a variety of problems if left unchecked. These species can effect native species abundance, create nuisance conditions, and also negatively effect fish populations. Once established, growth and physiological characteristics of Eurasian watermilfoil enable it to form a surface canopy and develop into immense stands of weedy vegetation, out competing most submersed species and displacing the native plant community (Madsen et al., 1988). At the time of the May survey, Eurasian watermilfoil had reached this canopy stage, especially on Oswego Lake.

Steps need to be taken in order to further control nuisance exotic aquatic species. The Lake Tippecanoe Property Owners Association has been able to raise enough funds to manage these species in the worst areas, but additional funding is needed to more aggressively pursue these species throughout the lakes. The 2004 survey comparison showed an increase in Eurasian watermilfoil in James Lake where no large-scale control efforts were completed while this species decreased in Lake Tippecanoe and Oswego where control efforts were initiated. In order to develop a scientifically sound and effective action plan for control of nuisance vegetation, all aquatic management alternatives need to be considered. The alternatives that will be discussed include: no action; environmental manipulation; chemical, mechanical, or biological control methods; and any combination of these methods.

A number of different techniques have been successfully used to control nuisance vegetation. These techniques vary in terms of their efficacy, rapidity, and selectivity, as well as the thoroughness and longevity of control they are capable of achieving. Each technique has advantages and disadvantages, depending on the circumstances. Selectivity is a particularly important characteristic of control techniques. Nearly all aquatic plant control techniques are at least somewhat selective, in that they affect some plant species more than others. Even techniques such as harvesting that have little selectivity within the areas to which they are applied can be used selectively, by choosing only certain areas in which to apply them. Selectivity can also occur after the fact, as when a technique controls all plants equally but some grow back more rapidly. One facet of selecting an appropriate aquatic plant control technique is matching the selectivity of the control technique with the goals of aquatic plant management. When controlling Eurasian watermilfoil, for example, it is typically desirable to use techniques that controls Eurasian watermilfoil with minimal impact on most native species (Smith, 2002).

No Action

What if no aquatic plant management activity took place on Lake Tippecanoe? Prior to control activities in the spring of 2004, Eurasian watermilfoil was present at 51% of sample sites in Oswego Lake, but in the August survey this species was present at only 10% of sample sites. This was likely a result of a fairly intense treatment effort focused on the control of Eurasian watermilfoil in Oswego Lake. On the other hand, James Lake was not treated for Eurasian watermilfoil even though this species was present (only the worst Eurasian watermilfoil areas of infestation were treated). In the May survey, Eurasian watermilfoil was found at 12% of sample sites. This species increased to 23% of sample sites in the August sampling. If no treatment activity is initiated it appears that this species may continue to spread throughout all of the lakes. The abundance of curlyleaf pondweed also decreased in all lakes, but this was likely due to the nature of that species to drop out of the water column in late summer (curlyleaf typically reaches maximum abundance in the spring or early summer and drops out by July).

Environment manipulation

Environmental manipulation for Lake Tippecanoe would include water level draw-down. Successful use of water draw-down for controlling aquatic vegetation typically requires drawing down water levels sufficiently to expose the entire plant population. Drawdown can result in the expansion of nuisance species into deeper water. Drawdown can also have negative affects on native plant species. Lake Tippecanoe could not be drawn down enough to reduce nuisance vegetation and there are also state imposed restrictions on lake levels that would have to be addressed.

Mechanical

Mechanical control includes cutting, dredging, or tilling the bottom sediments to eliminate aquatic plant growth. The main advantage to mechanical control is the immediate removal of the plant growth from control areas and the removal of organic matter and nutrients.

One of the most common mechanical control techniques used on larger lakes in Indiana is mechanical harvesting. Mechanical harvesting uses machines which cut plant stems and, in most cases, pick up the cut fragments for disposal. This type of mechanical control has little selectivity. Where a mix of Eurasian watermilfoil and native species exists, harvesting favors the plant species that grow back most rapidly following harvesting. In most cases, Eurasian watermilfoil recovers from harvesting much more rapidly than native plants. Thus, repeated harvesting hastens the replacement of native species by Eurasian watermilfoil and often leads to dense monocultures of Eurasian watermilfoil in frequently harvested areas. Harvesting also stirs up bottom sediments thus reducing water clarity, kills fish and many invertebrates, and hastens the spread of Eurasian watermilfoil via fragmentation

Residents of Lake Tippecanoe have the option to harvest areas of submersed vegetation in and around their docks or swimming areas. Residents should keep in mind that only a 625 square foot area can be harvested without obtaining a permit from IDNR.

Biological

Biological controls reduce aquatic vegetation using other organisms that consume aquatic plants or cause them to become diseased (Smith, 2002). The main biological controls for nuisance vegetation used in Indiana are the white amur (grass carp) and the milfoil weevil.

The white amur or grass carp *Ctenopharyngodon idella* is a herbivorous fish imported from Asia. Triploid grass carp, the sterile genetic derivative of the diploid grass carp, are legal for use in Indiana. Grass carp tend to produce all or nothing aquatic plant control. It is very difficult to achieve a stocking rate sufficient to selectively control nuisance species without eliminating all submersed vegetation. They are not particularly appropriate for Eurasian watermilfoil control because Eurasian watermilfoil is low on their feeding preference list; thus, they eat most native plants before consuming Eurasian watermilfoil (Smith, 2002). Grass carp are also difficult to remove from a lake once they have been stocked. Grass carp are not recommended for nuisance vegetation control in the Tippecanoe Lakes.

The milfoil weevil, *Euhrychiopsis lecontei*, is a native North American insect that consumes Eurasian and Northern watermilfoil. The weevil was discovered following a natural decline of Eurasian watermilfoil in Brownington Pond, Vermont (Creed and Sheldon, 1993), and has apparently caused declines in several other water bodies. Weevil larvae burrow in the stem of Eurasian watermilfoil and consume the vascular tissue thus interrupting the flow of sugars and other materials between the upper and lower parts of the plant. Holes where the larvae burrow into and out of the stem allow disease organisms a foothold in the plants and allow gases to escape from the stem, causing the plants to lose buoyancy and sink (Creed et al. 1992).

Concerns about the use of the weevil as a biological control agent relate to whether introductions of the milfoil weevil will reliably produce reductions in Eurasian watermilfoil and whether the resulting reductions will be sufficient to satisfy users of the lake (Smith, 2002). Following our research, no conclusive data concerning the role of weevils in reducing Eurasian watermilfoil populations has been made available. In 2003, Scribailo and Alix conducted a weevil release study on three Indiana lakes and had no conclusive evidence supporting the use of weevils in reducing milfoil populations. Weevils may reduce milfoil populations in some lakes, but predicting which lakes and how much, if any, control will be achieved has not been documented (Scribailo & Alix, 2003).

Chemical Control

Chemical control uses chemical herbicides to reduce or eliminate aquatic plant growth. The main disadvantage to the use of chemicals is the publics concern over safety. Extensive testing is required of aquatic herbicides to ensure that the herbicides are low in toxicity to human and animal life and they are not overly persistent or bioaccumulated in fish or other organisms. It often takes several decades of testing by the Environmental Protection Agency (E.P.A.) before a herbicide is approved for aquatic use. After E.P.A approval and registration, the herbicide must go through the registration process in each state.

Another disadvantage to the use of aquatic herbicides is water use restrictions. These restrictions must be posted prior to treatment on a public body of water. The most common restriction is irrigation. Another disadvantage to the use of herbicides is the release of nutrients that can occur if large areas of vegetation are controlled. This can be avoided by early application that controls vegetation before it reaches its maximum biomass. These perceived disadvantages are often times out-weighed by this technique's proven rapid effectiveness and selectivity.

There are two different types of aquatic herbicides; systemic and contact. Systemic herbicides are translocated throughout the plants and thereby kill the entire plants. Fluridone (trade name Sonar & Avast!), 2,4-D (trade name Navigate, Aqua-Kleen, & DMA4 IVM), and trichlopyr (trade name Renovate) are systemic herbicides that can effectively control Eurasian watermilfoil.

Based upon the author's experience and personal communication with a vast array of North American aquatic plant managers, whole-lake fluridone applications are by far the most effective means of controlling Eurasian watermilfoil. Successful fluridone treatments yield a dramatic reduction in the abundance of Eurasian watermilfoil, often reducing it to the point that Eurasian watermilfoil plants are difficult to detect following treatment (Smith, 2002). An advantage to using fluridone over most contact herbicides is its selectivity. Most strains of Eurasian watermilfoil have a lower tolerance to fluridone than the majority of native species, so if the proper rates are applied Eurasian water milfoil can be controlled with little harm to the majority of native species. In our opinion, the Tippecanoe chain does not have an extensive enough Eurasian watermilfoil problem to warrant the expense which would be required to complete such a whole-lake treatment.

Triclopyr is a systemic herbicide that has recently been approved for use in aquatics. Triclopyr typically is used for treating isolated milfoil beds as opposed to whole lake treatments. This herbicide is very selective to Eurasian watermilfoil. A study was conducted in 1997 during the registration process of this herbicide. The study found Eurasian watermilfoil biomass was reduced by 99% in treated areas at 4 weeks post-treatment, remained low one year later, and was still at acceptable levels of control at two years post-treatment. Non-target native plant biomass increased 500-1000% by one year post-treatment, and remained significantly higher in the cove plot at two years post-treatment. Native species diversity doubled following herbicide treatment, and the restoration of the community delayed the re-establishment and dominance of Eurasian watermilfoil for three growing seasons (Getsinger et. al., 1997). Triclopyr is a good alternative to fluridone when Eurasian watermilfoil is not abundant throughout an entire water body. This herbicide has been used in Lake Tippecanoe for Eurasian watermilfoil control in 2003 and 2004. It has effectively controlled milfoil and caused an increase in native vegetation within treatment areas. Long-term control of Eurasian watermilfoil with triclopyr herbicide has not occurred on Lake Tippecanoe. This is may be due to the treatment strategy which focuses on soley treating areas where Eurasian watermilfoil has reached nuisance levels. This leads to quick reintroduction from untreated areas. If longer term control is desired, Eurasian watermilfoil must be treated everywhere it is located in the lake. The only water use restriction following a triclopyr treatment is irrigation. An assay is needed to monitor the concentration in the water before irrigation can take place. Assays have been completed on Lake Tippecanoe and Oswego Lake following past treatments. Main lake areas can typically irrigate within 1 day and isolated areas typically take 3 days before triclopyr levels are low enough for irrigation.

Applied properly, 2,4-D can also yield major reductions in the abundance of Eurasian watermilfoil. Treatments must be even and dose rates accurate. Under the best circumstances, some areas will probably need to be treated repeatedly before the Eurasian watermilfoil in them is controlled. Also, the difficulty of finding and treating areas of sparse Eurasian watermilfoil makes it likely that Eurasian watermilfoil will be reestablished from plants surviving in these areas (Smith 2002). This formulation should be used much like Triclopyr, but the same results may not occur. Unlike Triclopyr, 2,4-D can impact the native species coontail. This herbicide can be applied for less cost than triclopyr, but damage will likely occur to coontail which is abundant in most areas of the Tippecanoe chain. This herbicide should be considered as an alternative to triclopyr applications if the POA's budget is restricted.

Contact herbicides can also be effective for controlling submersed vegetation in the short term. The three primary contact herbicides used for control of submersed vegetation are diquat (trade name Reward), endothal (trade name Aquathol), and copper based formulations (trade names Komeen, Nautique, and Clearigate).

Historically, a drawback to the use of contact herbicides has been the lack of selectivity exhibited by these herbicides. However, a study recently completed by Skogerboe and Getsinger in 2002 outlines how endothal can be used for control of the exotic species curlyleaf pondweed and Eurasian watermilfoil with little effect on the majority of native species. They found early season treatments with endothall effectively controlled Eurasian watermilfoil and curlyleaf pondweed at several application rates with no regrowth eight weeks after treatment. Sago pondweed, eel grass, and Illinois pondweed biomass were also significantly reduced following the endothall application, but regrowth was observed at eight weeks post-treatment. Coontail and elodea showed no effects from endothall at three of the lower application rates. Spatterdock, pickerelweed, cattail, and smartweed were not injured at any of the application rates (Skogerboe & Getsinger 2002). This type of treatment strategy could be applied to lakes that have large areas of both curlyleaf pondweed and Eurasian watermilfoil. Endothal could also be effective the year after whole lake sonar treatments where curlyleaf pondweed typically returns the following season. Endothal has been used for many years in Lake Tippecanoe for control of Eurasian watermilfoil and mixed pondweeds. Results have been mixed, but this may be due to the limited areas which were treated resulting in reinfestation from untreated areas of the lake. Endothal can also be used at low doses for control of curlyleaf pondweed. This treatment strategy has been used the past two years in select areas of the Tippecanoe lakes.

Diquat and many of the copper formulations are effective fast acting contact herbicides. These formulations are typically used when control of all submersed vegetation is desired. These herbicides are commonly used for control of nuisance vegetation around docks and near-shore high-use areas. These herbicides are not selective and plants can often times recover in 4-8 weeks after treatment. A copper formulation trade named Nautique, was used in 2004 for control of eel grass in nuisance areas. Copper based herbicides are the main chemicals used for control of this species. This herbicide should continue to be used in areas where eel grass is deemed a nuisance. There are no water use restrictions following the use of chelated copper.

Table 17. Advantages and disadvantages of potential control methods.

Control Method	Advantages	Disadvantages	Conclusion
No Action	No cost, less controversy	No plant control, degradation of fish habitat, difficult boating, and spread of exotics plant species.	Something should be initiated to prevent spread of milfoil and reduce nuisance conditions.
Environmental Manipulation (drawdown)	Low cost, compaction of flocculent sediments, may get control of some nuisance species, and less controversial.	Unpredictable plant control, exposes desirable plants and animals to freezing and thawing, dependent on good freeze, could impede recreation, dependent on spring rains to raise water level, and not feasible for Tippe chain.	Not feasible for Tippe chain due to depth of exotic plant growth and difficulty in manipulation of water level.
Mechanical (cutting, dredging, or tilling)	Low cost, less controversy, and one can target areas of desired control, removes organics.	Possibility of spreading exotic vegetation, labor intensive, damage to fish and other aquatic organisms, and harvesting can promote increased milfoil growth.	Not good option due to potential spread of exotics. Could possibly be used on small-scale initial infestation or post-treatment.
Biological Control (milfoil weevil)	No chemical needed, naturally occurring native species, no use restrictions following application, selective for Eurasian watermilfoil, and known to cause fatal damage to plant	Studies have been inconclusive on the effectiveness and cost is relatively high compared to most other control methods. Will not control curlyleaf pondweed. Limited success in previous application to Lake Tippecanoe.	No proof that this method is effective. Too large of an investment for unproven method.
Biological Control (Grass Carp)	No chemical needed, no use restrictions following application, and proven to consume aquatic vegetation.	Prefers many of the native species over exotic species, non-native fish species, tend to move downstream, once they are introduced they are nearly impossible to remove.	Not a good option due to inability to remove once stocked and preference for native vegetation.
Chemical Control	Proven safe and effective technique, can be selective, relatively easy application, and fast results.	Higher cost than most techniques, public concern over chemicals, build-up of dead plant material following application, and lake use restrictions	Proven to be effective & minimal use restrictions very effective and selective for curlyleaf pondweed and Eurasian watermilfoil control

Action Plan

The focus of the action plan should be the control of invasive exotic plant species. These species include Eurasian watermilfoil and curlyleaf pondweed. Due to a limited budget, the current management strategy involves application of triclopyr and endothal herbicide only to areas where Eurasian watermilfoil and curlyleaf pondweed have reached nuisance levels. For example, Eurasian watermilfoil was present in several areas of James Lake, but no treatment activity was initiated in 2004 because there were denser milfoil beds located in Oswego and Lake Tippecanoe. Due to budget constraints, the association was forced to allocate treatments to areas where these species were causing the most problems. This strategy has been effective at reducing the short-term impact of this species in certain areas, but Eurasian watermilfoil continues to reinfest treatment areas and spread to new areas throughout all three lakes. A more aggressive action plan should be initiated. All areas where Eurasian watermilfoil is located should be treated with triclopyr herbicide. Curlyleaf pondweed should continue to be treated throughout all three lakes with low doses of endothal. These treatments should reduce the abundance of these two species of nuisance exotic vegetation and allow for the increase in beneficial native vegetation. This type of treatment should take place following spring vegetation sampling. It is difficult to predict how large of an area will need to be treated prior to the spring sampling, but based on past surveys, between 80 and 90 acres may require treatment. If this control measure is initiated it should result in a decrease needed control in future years (Table 18). The exact amount of control required in future years is impossible to predict and should be based on plant surveys. This type of treatment should preserve and enhance the population of native vegetation and relieve nuisance conditions caused by Eurasian watermilfoil. Ideally, the objective is to eliminate this exotic species, but in a waterbody of this size combined with inflow from other Eurasian watermilfoil infested lakes, this objective is likely not obtainable. A more realistic objective for this treatment is to maintain Eurasian watermilfoil below 10% frequency of occurrence in all three lakes and reduce relative density below 0.20.

In addition to control of the exotic species Eurasian watermilfoil and curlyleaf pondweed, eel grass should also be chemically controlled in nuisance areas. In 2004, Aquatic Control, Aquatic Weed Control, IDNR fisheries biologists, and the president of the POA conducted a visual survey in order to define nuisance areas of eel grass. Following the survey, selected areas where eel grass was causing the greatest problems were allowed to be treated. Bringing all of these parties together is a difficult task. This treatment should be planned only after summer plant sampling is completed. An up to date map of the proposed treatment areas could then be supplied prior to the treatment (a map must be supplied for permitting, but it is difficult to predict where this species will reach nuisance levels). In the future, the IDNR biologist should visually survey these areas and mark the map or give waypoints to areas where treatment will be allowed. It is estimated that between 5 to 15 acres may require treatment in 2005. These treatments should be based on keeping boating lanes open to deeper water in an effort to reduce the free floating fragments which can form dense near-shore mats. The association should also work to reduce high speed boating in shallow areas. This should also reduce the amount of eel grass fragmentation caused by this activity.

Aquatic vegetation sampling should be a part of any action plan. This sampling should consist of a Tier I survey and a pair of Tier II surveys. These surveys should be completed in mid to late May and late July. Such surveys will monitor the long-term effects of herbicide treatments, document areas that require action, and determine if adjustments need to be made in the management strategy.

The exotic species purple loosestrife has been noticed is some wetland areas. The focus of the 2004 sampling was on submersed aquatic vegetation. A sampling method should be created in order to determine the abundance of emergent or wetland vegetation in order to better quantify the density and abundance of this invasive species. Following the sampling an action plan should be created in order to reduce the abundance and limit the spread of this species.

Another exotic species may be present in Oswego Lake. This plant is a rooted floating leaved species commonly referred to as lotus. This species produces large flowers in late summer and is often planted in water gardens. Aquatic Control biologist initially identified it as American lotus (*Nelumbo lutea*); however, a former Aquatic Control biologist initially identified it as an exotic species of lotus due to the difference in flower color. A sample of this plant should be analyzed to determine the exact species and control actions may be necessary to prevent the spread of this species.

It is important that the property owners association maintains control of treatment activities in the main lake areas of Lake Tippecanoe, James, and Oswego Lake (excluding man-made channels). Treatments should be completed based on the recommendations of this plan. This will reduce controversy with property owners and IDNR (IDNR has expressed concern over the issuing of multiple permits for 1 lake chain). Adherence to this plan will also allow for the plant community to be more accurately monitored and managed. Currently, it is impossible to compile a treatment history on these lakes prior to 2003 due to the multiple permits and companies which completed work on this chain. It will be hard to monitor changes in the plant community if individual lots or areas are treated outside the recommendations of this plan.

Table 18. Budget estimate for action plan

	2005	2006	2007	2008
Herbicide & Application Cost (Eurasian watermilfoil & curlyleaf pondweed only)	$35,000	$30,000	$25,000	$20,000
Herbicide & Application Cost (late summer eel grass)	$5,000	$5,000	$5,000	$5,000
Vegetation Sampling & Plan Update	$5,000	$5,000	$5,000	$5,000
Total:	**$45,000**	**$40,000**	**$35,000**	**$30,000**

Education

It is important that all lake users, lake residents, and other stakeholders participate and be informed about the lake management activities. A meeting was conducted November 23, 2004 in order to obtain user input and discuss the updated management plan. Only nine lake users were present at the meeting despite a notice being place in the local paper and posted on the Internet. Each winter a meeting should take place to discuss necessary changes in the plan and to update lake users of changes and activities. The POA newsletter should continue to be used to discuss aquatic vegetation management activities, treatment restrictions, and management options. Signs should be posted at public and private ramps informing lake users of the dangers of transporting exotic vegetation and in order to inform lake users of any restrictions due to treatment activities. Residents should also be advised against planting vegetation obtained from aquarium or water garden stores. Some nuisance exotic species have been introduced by this method. Information concerning this plan should be posted on the association's website. Additional information concerning aquatic vegetation management can be obtained at the following web sites: www.mapms.org, www.aquatics.org, www.apms.org, www.aquaticcontrol.com, or www.nalms.org.

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Appendix A. Macrophyte List for the Tippecanoe Chain (Oswego, Tippecanoe, & James)

Common Name	Scientific Name	2002 Survey	2003 Survey	2004 Survey
American elodea	*Elodea canadensis*	X	X	X
American pondweed	*Potamogeton nodosus*	X	-	X
Bladderwort	*Utricularia spp.*	X	-	X
Chara	*Chara spp.*	X	X	X
Common coontail	*Ceratophyllum demersum*	X	X	X
Curlyleaf pondweed	*Potamogeton crispus*	X	X	X
Eel grass	*Vallisneria Americana*	X	X	X
Eurasian watermilfoil	*Myriophyllum spicatum*	X	X	X
Flatstem pondweed	*Potamogeton zosteriformis*	X	X	X
Horned pondweed	*Zannichellia palustris*	-	X	X
Illinois pondweed	*Potamogeton illinoensis*	X	-	X
Largeleaf pondweed	*Potamogeton amplifolius*	X	X	X
Leafy pondweed	*Potamogeton foliosus*	-	-	X
Lotus	*Nelumbo spp.*	X	-	X
Northern watermilfoil	*Myriophyllum sibiricum*	X	-	-
Pickerel weed	*Pontederia cordata*	X	-	-
Richardson's pondweed	*Potamogeton richardsonii*	X	X	X
Sago pondweed	*Potomogeton pectinatus*	X	-	X
Slender naiad	*Najas flexilis*	X	-	-
Spiny naiad	*Najas marina*	X	-	X
Variable pondweed	*Potamogeton gramineus*	X	X	X
Water stargrass	*Zosterella dubia*	X	X	X
White water lily	*Nymphaea odorata*	X	X	X
Whorled watermilfoil	*Myriophyllum verticillatum*	X	X	X
Spatterdock	*Nuphar spp.*	X	X	X

Lotus *(Nelumbo spp.)* is an emergent dicot with a large circular leaf which often reaches several feet above the waters surface. Provides shade and shelter for fish. Young seeds are often eaten by waterfowl. Rootstocks are eaten by muskrats and beaver.

American pondweed (*Potomogeton nodosus*) is a perennial herb that often times is referred to as longleaf pondweed. Contains submersed and floating leaves. Occupies shallow water. Occurs throughout North America. Reproduces through rhizomes and seeds.

Chara (*chara spp.)* is an anchored green algae with whorled, branchlike filaments at the nodes of a central axis. Often times mistaken for vascular plants. Typically inhabits shallow water. Provide food and cover for wildlife. Rarely reaches the surface of the water and rarely causes problem.

Common coontail (*Ceratophylum demersum*) is a commonly occurring aquatic plant in the Midwest in neutral to alkaline waters[1]. It is a submersed dicot with coarsely toothed leaves whorled about the stem[2]. This plant is given its name due to its resemblance to the tail of a raccoon. Coontail has been found to be an important food source for wildfowl as well as a good shelter for small animals[2]. This plant is also a good shelter for young fish, and support of insects[2], but has been known to crowd out other species of aquatic plants[3].

Curlyleaf pondweed (*Potamogeton crispus*) is a submersed monocot with slightly clasping, rounded tip leaves. The flowers occur on dense cylindrical spikes and produces distinctive beaked fruit[1]. Curly leaf is eaten by ducks, but may become a weed[2]. This plant provides good food, shelter, and shade for fish and is important for early spawning fish like carp and goldfish[2].

Eurasian watermilfoil (*Myriophyllum spicatum*) is an exotic aquatic plant that has been known to crowd out native species of plants. This species spreads quickly because it can grow from very small plant fragments and survive in low light and nutrient conditions[3]. This dicot has stems that typically grow to the water surface and branch out forming a canopy that shades other species of aquatic plants. Eurasian water-milfoil has characteristic red to pink flowering spikes that protrude from the water surface one to two inches high[1]. The segmented leaves grow in whorls of three to four around the stem[1]. grow from very small plant fragments and survive in low light and nutrient conditions[4]. This dicot has stems that typically grow to the water surface and branch out forming a canopy that shades other species of aquatic plants. Eurasian water-milfoil has characteristic red to pink flowering spikes that protrude from the water

[1] Chadde, S. 1998. Great lakes wetland flora. Pocketflora Press, Calumet, Michigan.

[2] Fassett, N. 1957. A manual of aquatic plants, 2nd edition. The University of Wisconsin Press, Madison, Wisconsin.

[3]Applied Biocehmists, 1998. Water weeds and algae, 5th edition. Applied Biochemists, J. C. Schmidt and J. R. Kannenberg, editors. Milwaukee, Wisconsin. (all plant illustrations supplied by Applied Biochemist)

surface one to two inches high[1]. The segmented leaves grow in whorls of three to four around the stem[1]. This exotic plant is easily differentiated from its native relative, northern milfoil, by stem growth and the numbers of sections per leaf.

Horned pondweed (*Zannichellia palustris*) is a common perennial aquatic herb with creeping rhizome and often forming extensive underwater mats. Flowers are small, produced underwater, either male or female, and separate on plant but from the same leaf axil. Plant usually common in spring and senesces in summer.

Sago pondweed (*Potamogeton pectinatus*) is a submersed monocot with leaves that are threadlike to narrowly linear that form a sheath around the stem[1]. The nutlet and tubers of this plant make it the most important pondweed for ducks[2]. It also provides food and shelter for young trout and other fish[2]. This species can produce thick nuisance growth in shallow near-shore areas of lakes.

Spatterdock (*Nuphar spp.*) is an emergent dicot with broad, deeply lobed leaves emerging from the water[1]. This plant has distinctive large yellow flowers emanating from spikes. Spatterdock produces seeds and rootstocks that are used by wildfowl, beaver, moose and porcupine[2]. This plant attracts wildfowl and marsh birds and the bases of the petioles are eaten by muskrats[2]. Spatterdock is a poor producer of food for fish, but provides good shade and shelter[2].

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[1] Chadde, S. 1998. Great lakes wetland flora. Pocketflora Press, Calumet, Michigan.

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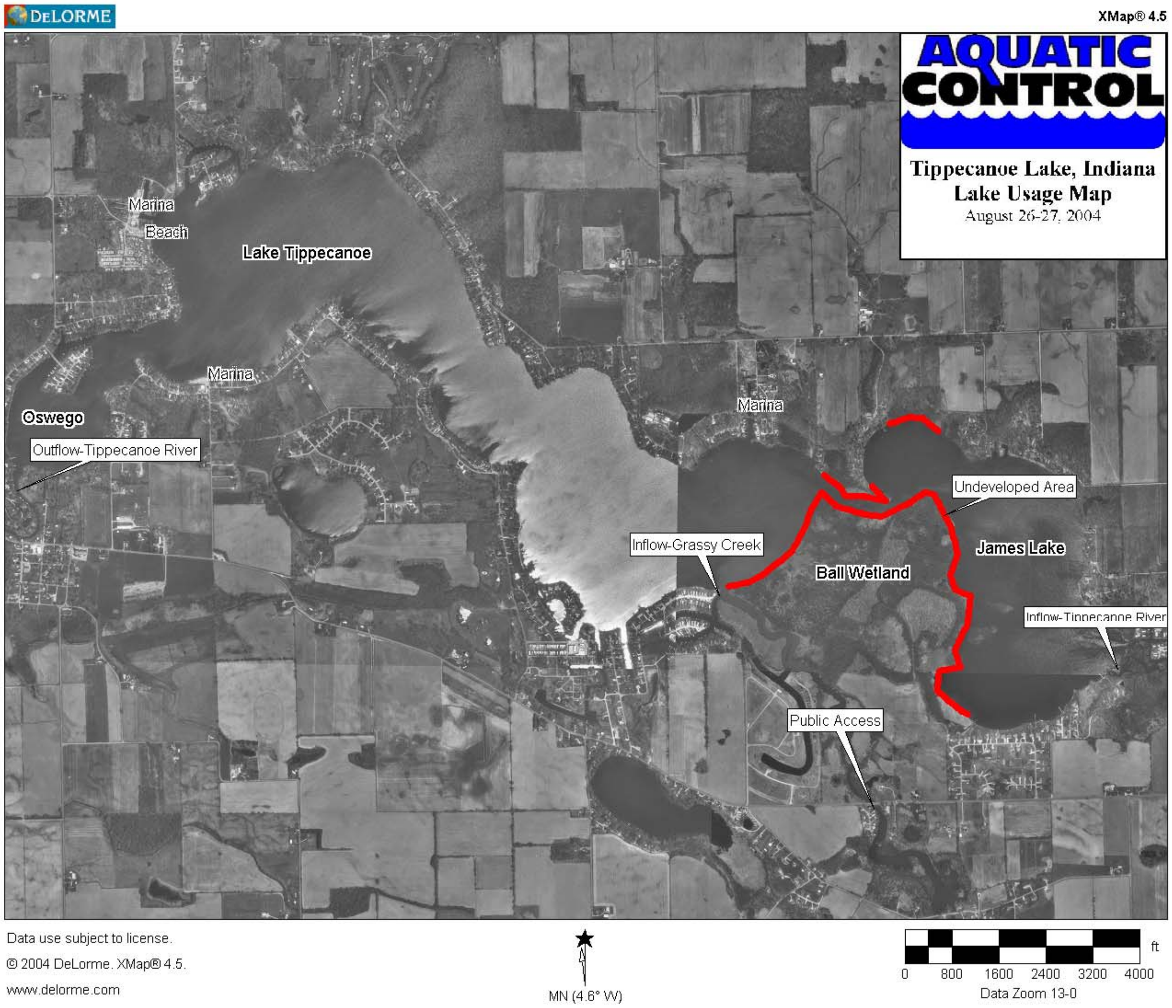
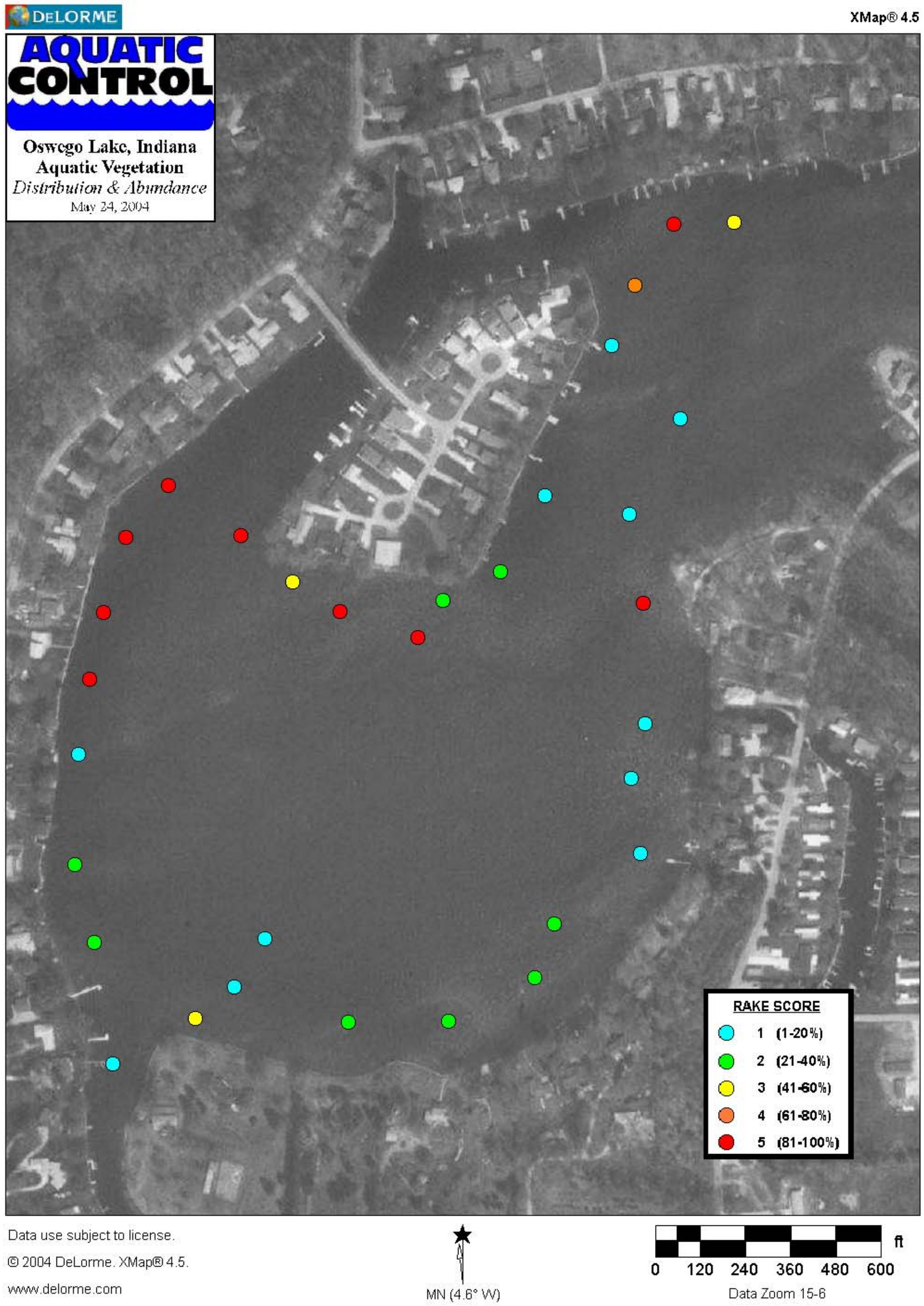
Appendix B. Maps

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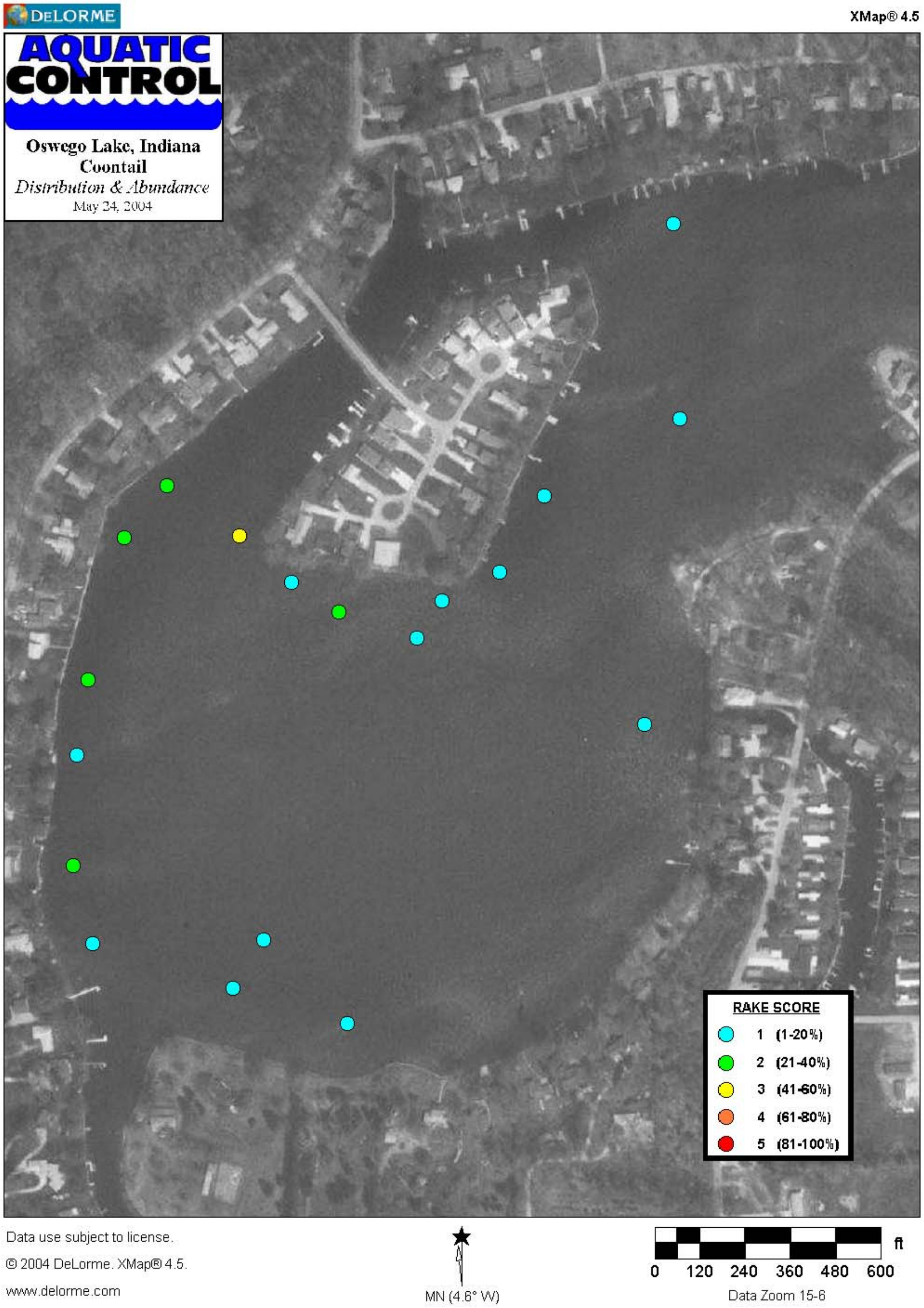
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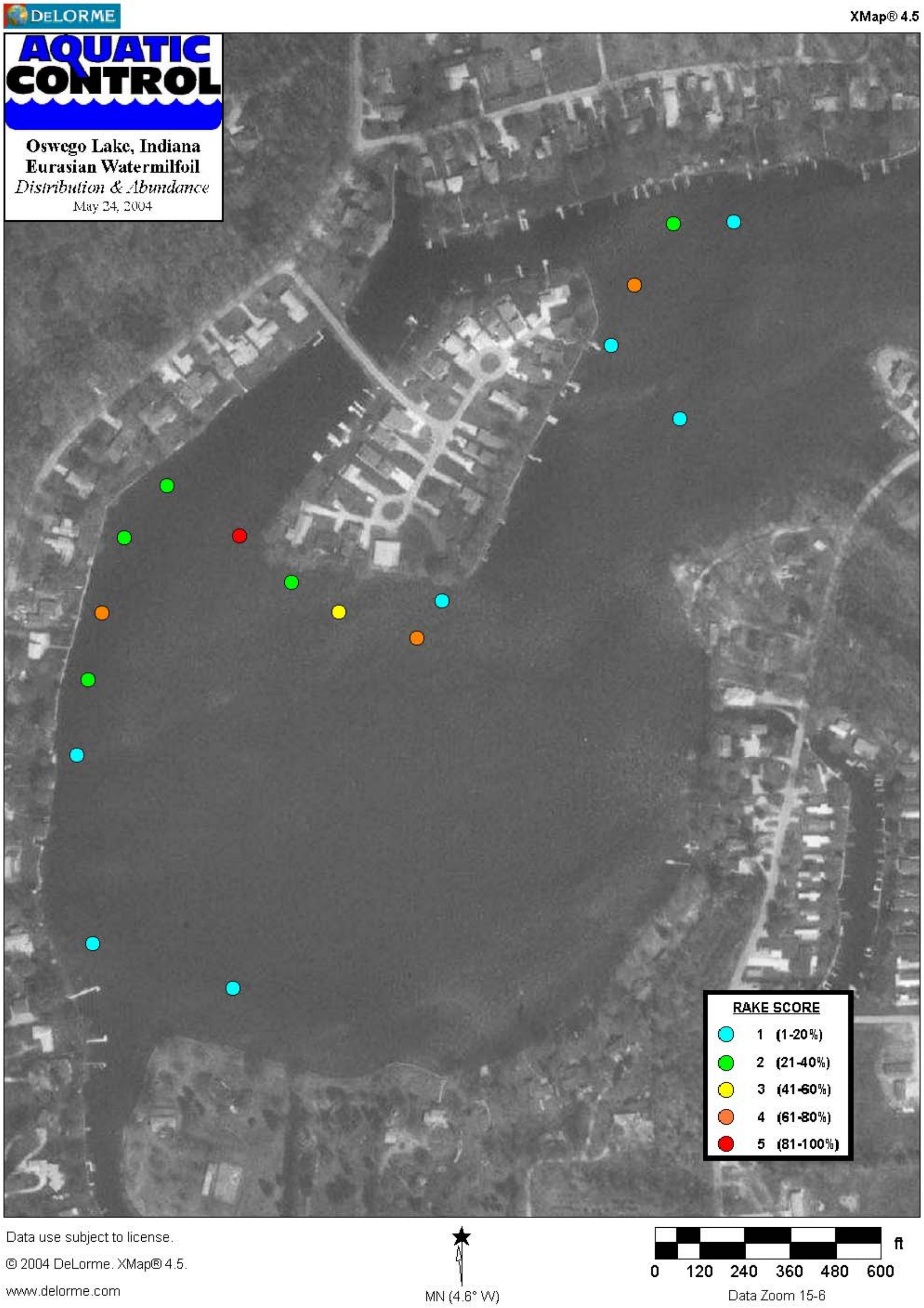
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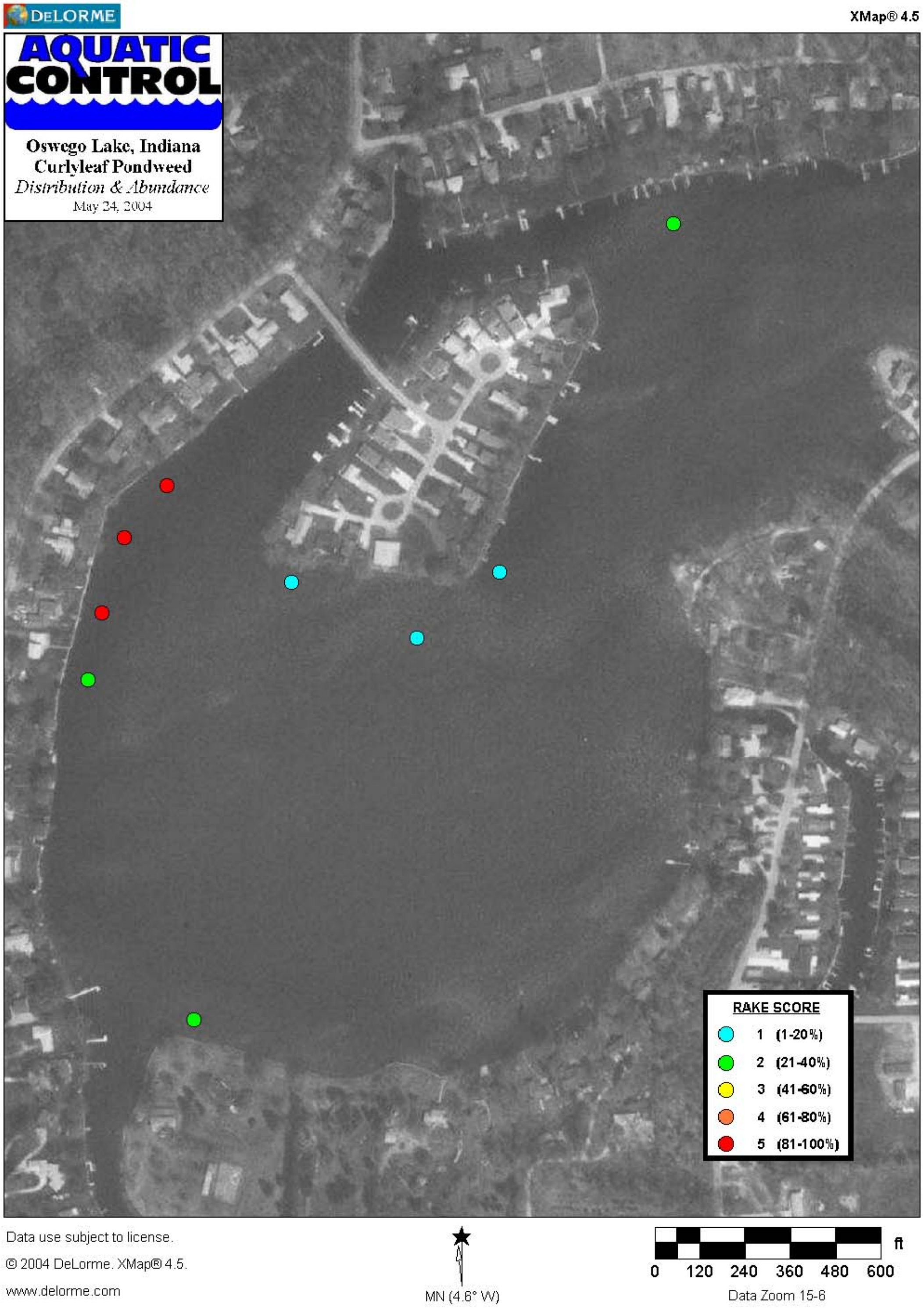
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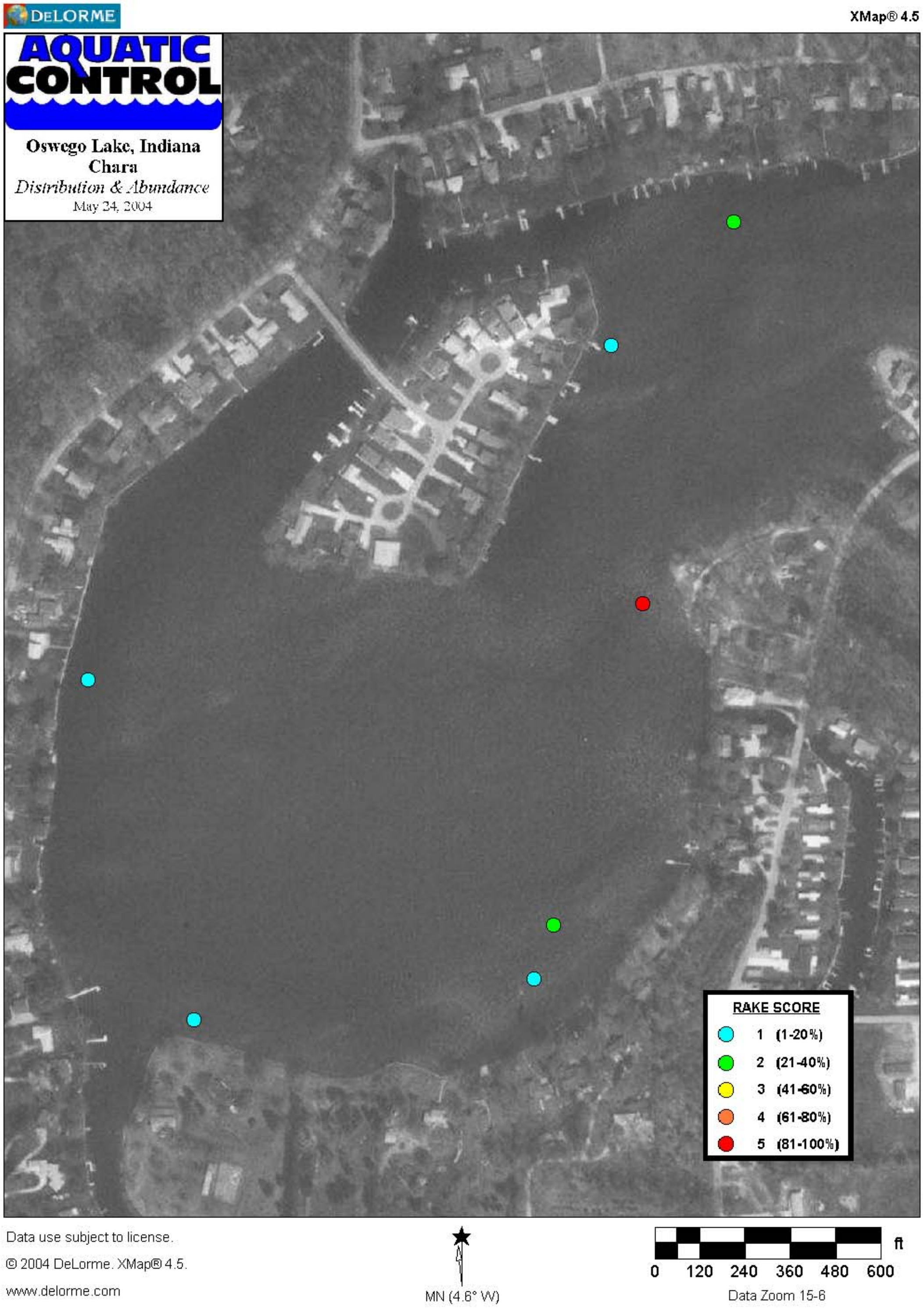
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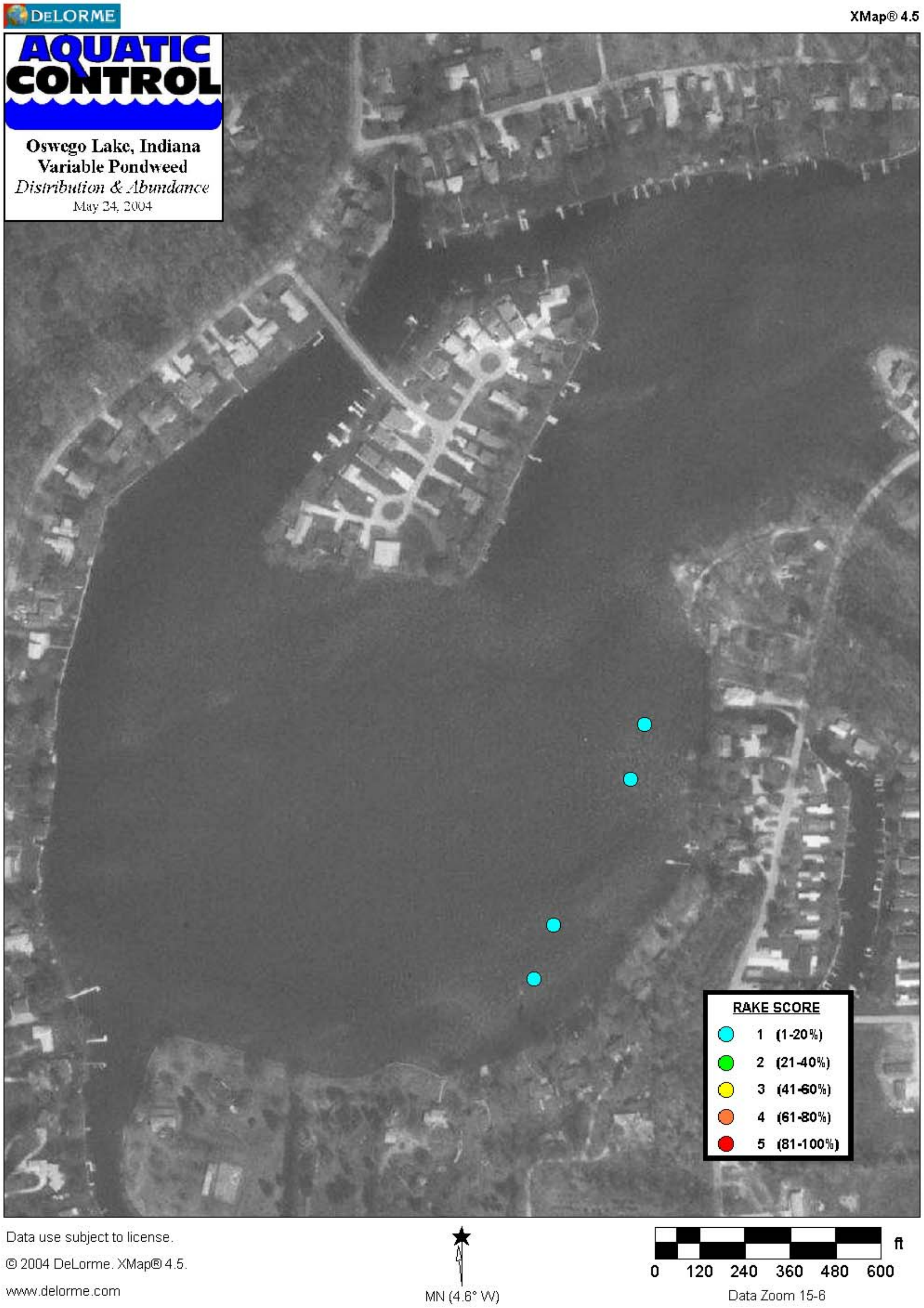
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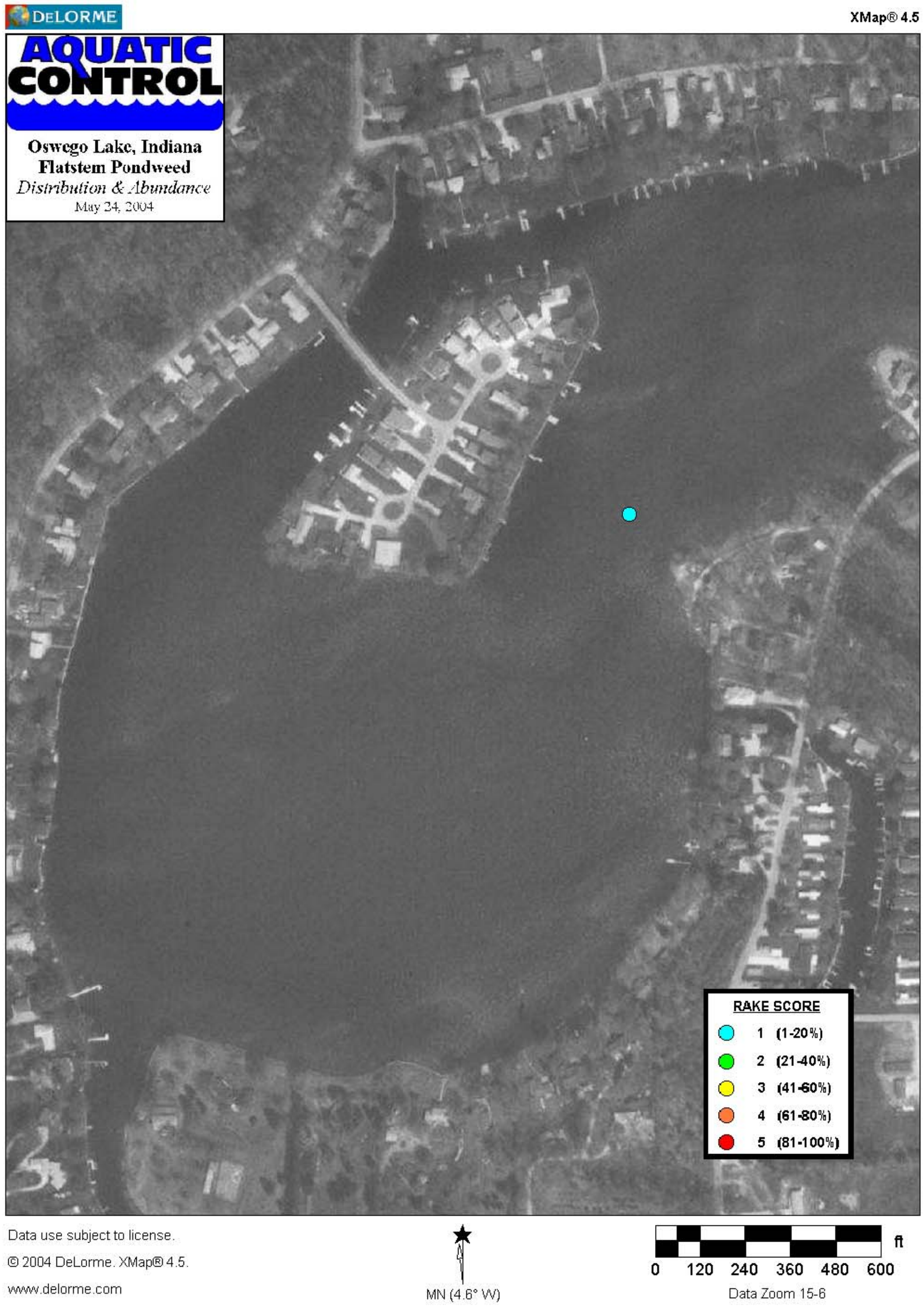
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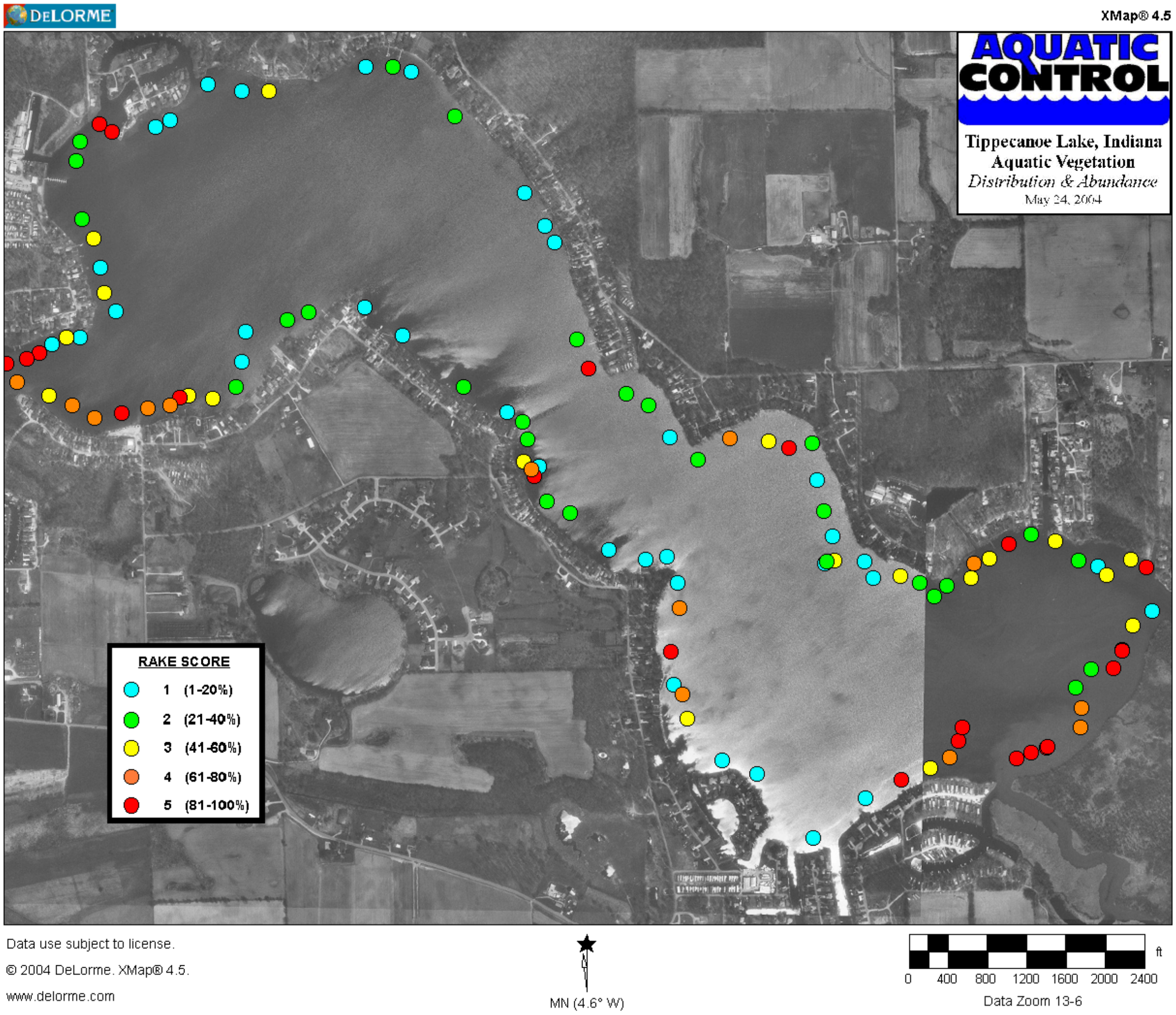
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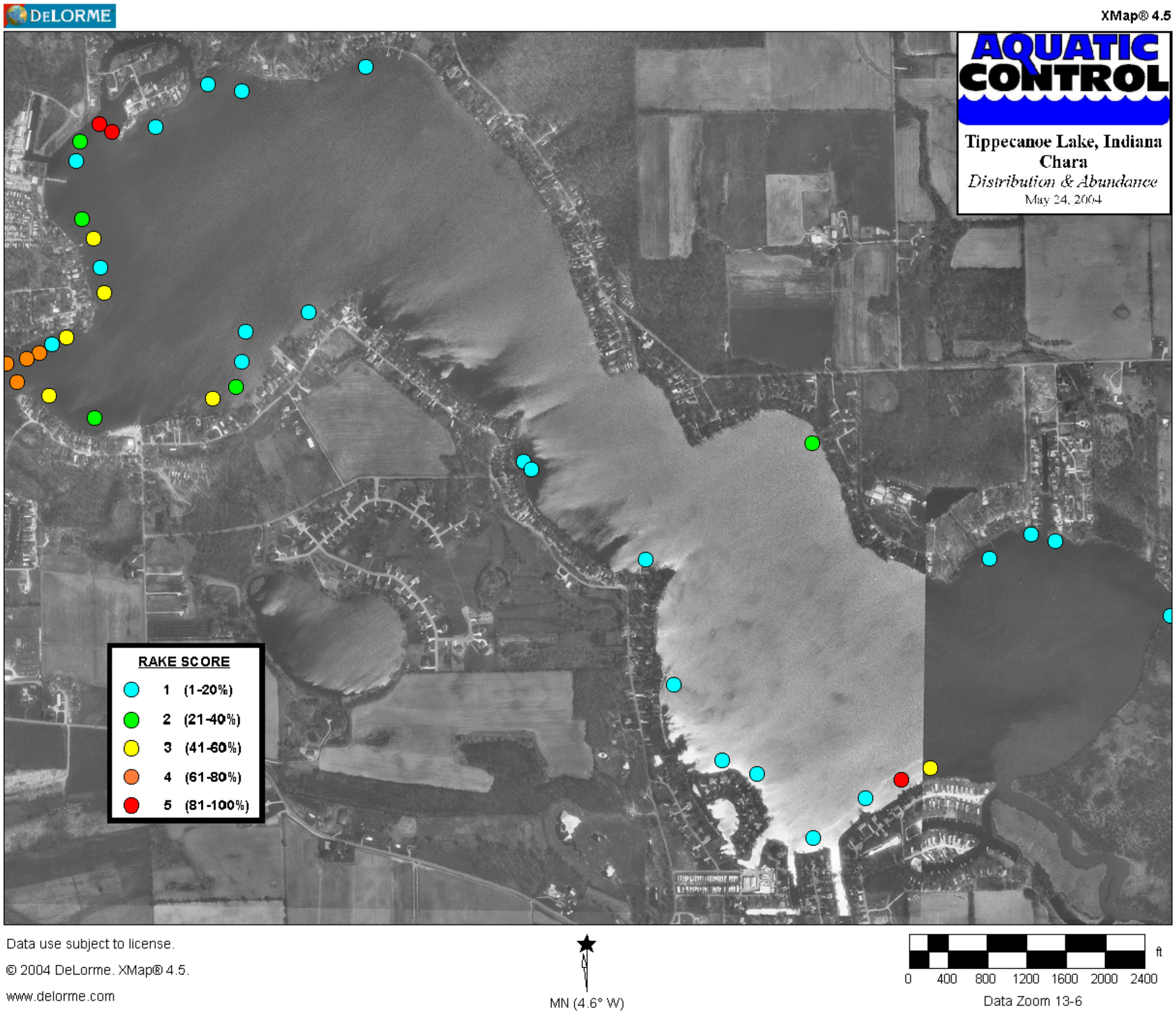
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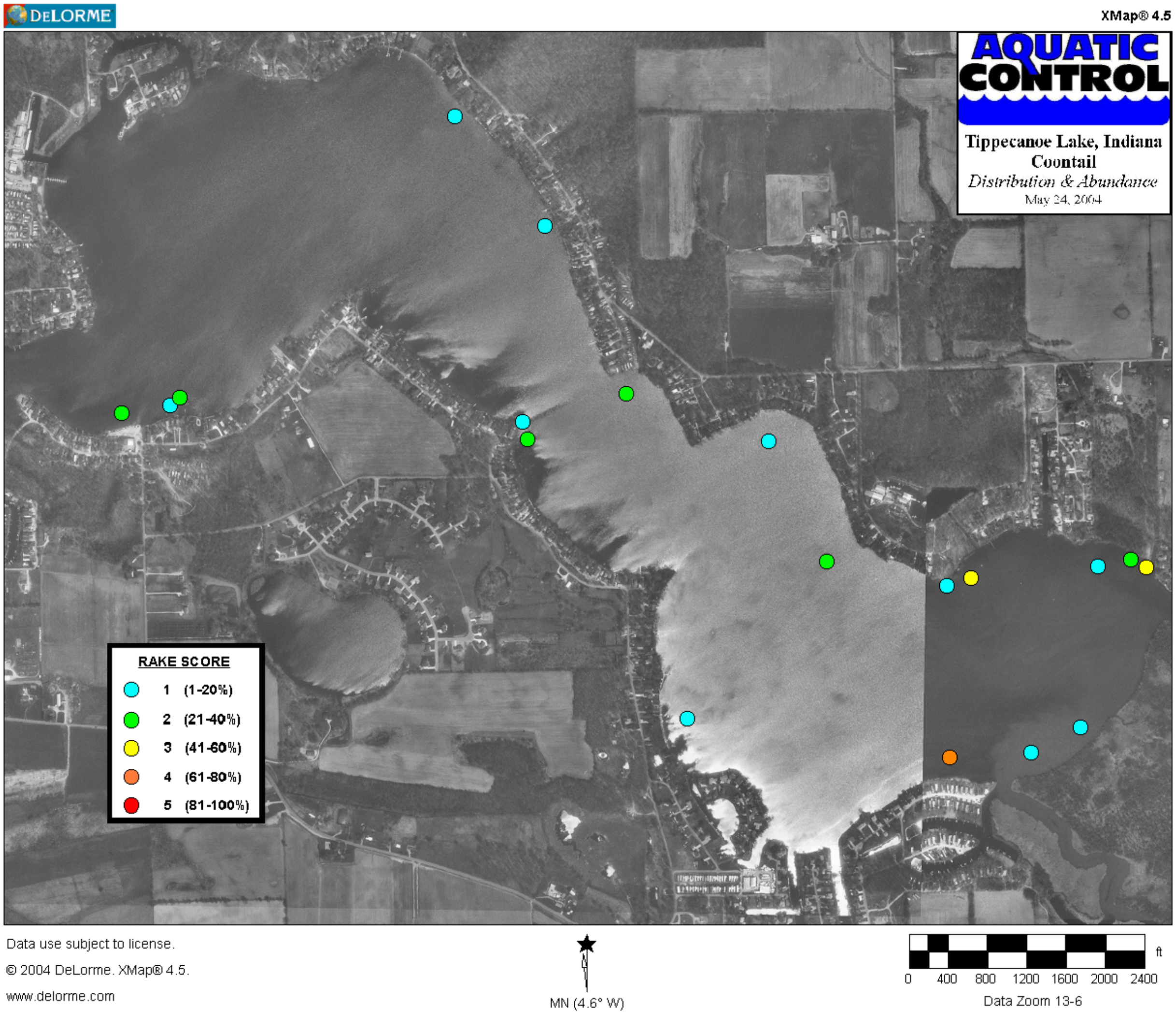
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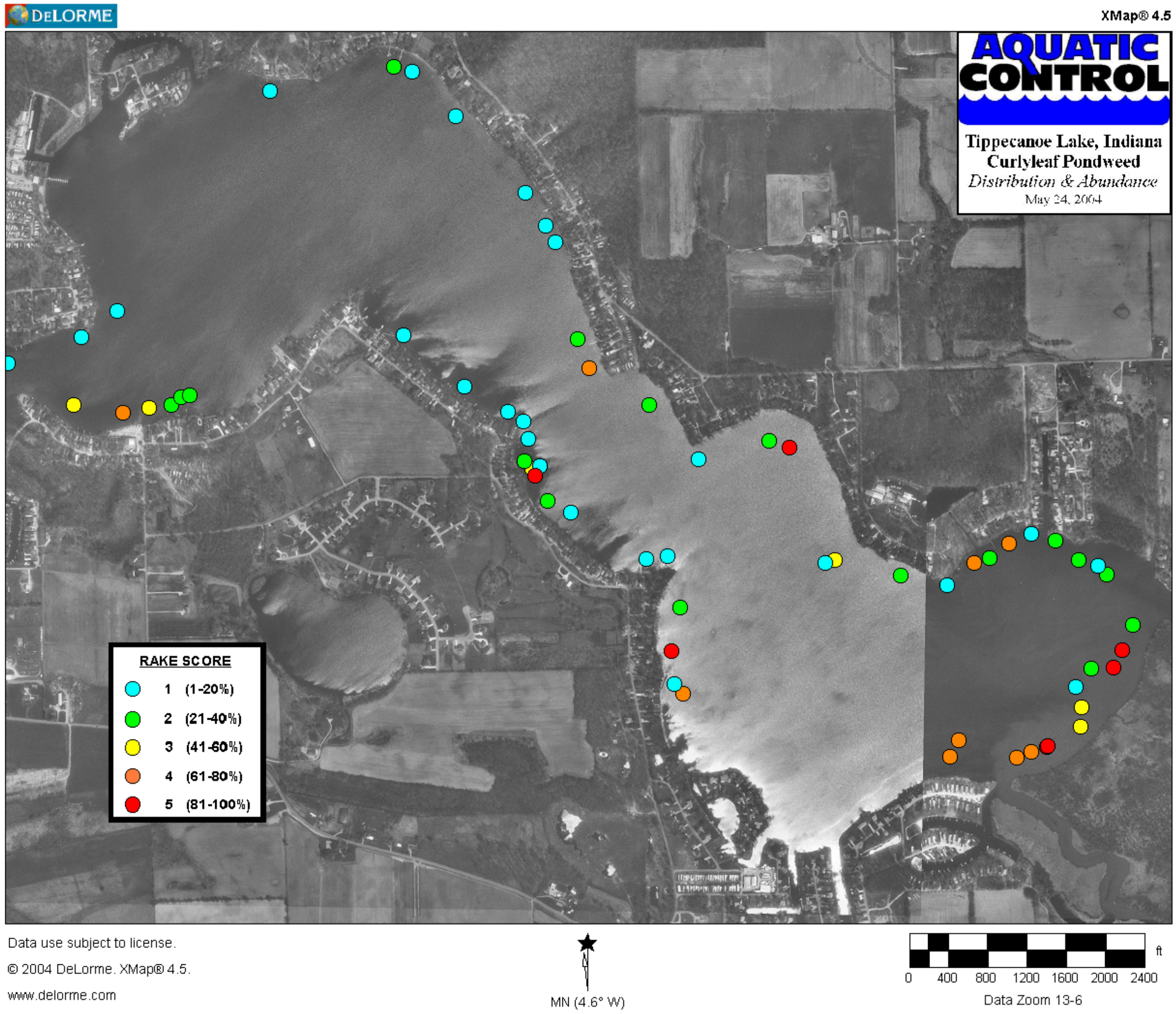
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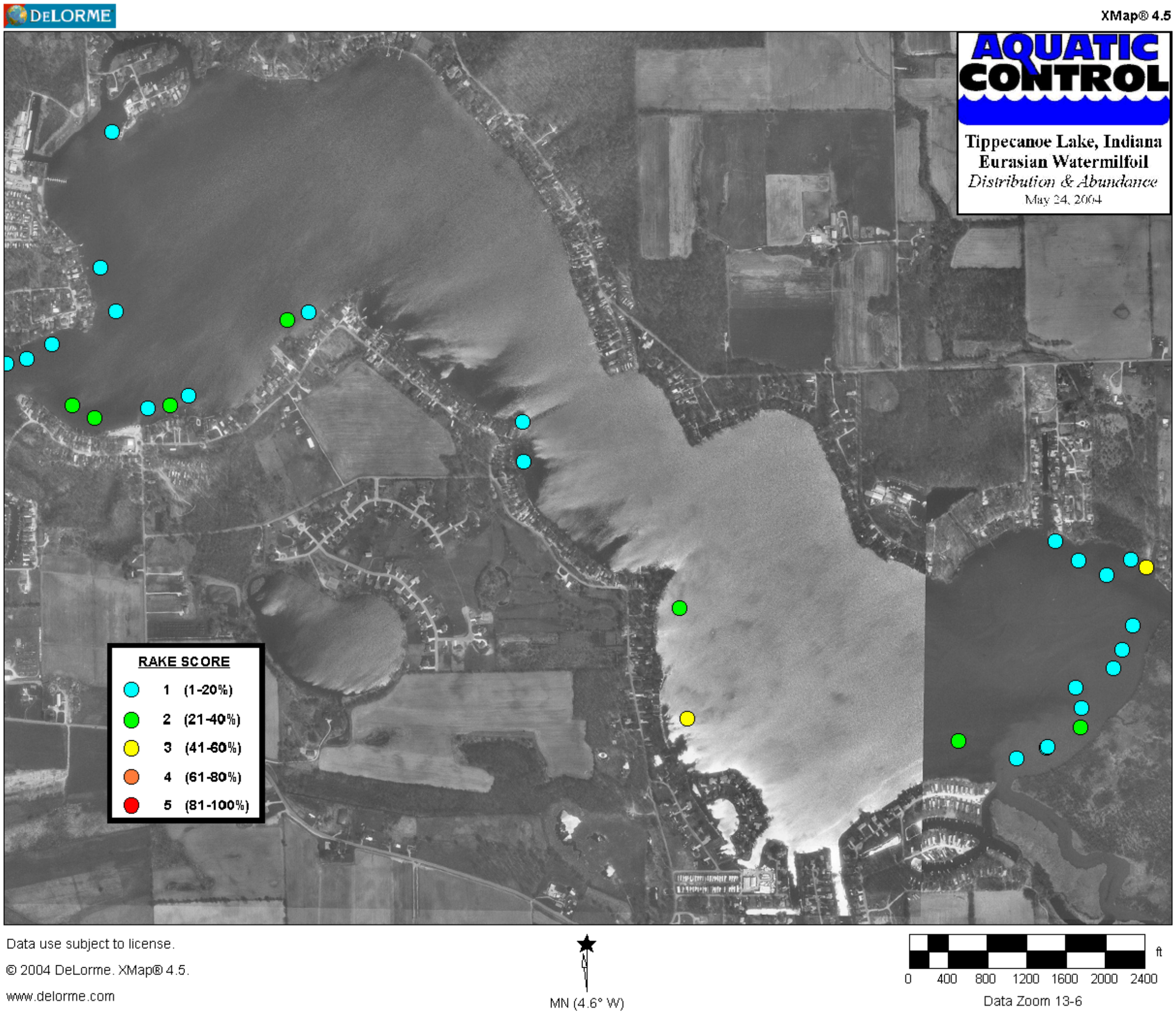
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Tippecanoe Lake, Indiana
Eurasian Watermilfoil
Distribution & Abundance
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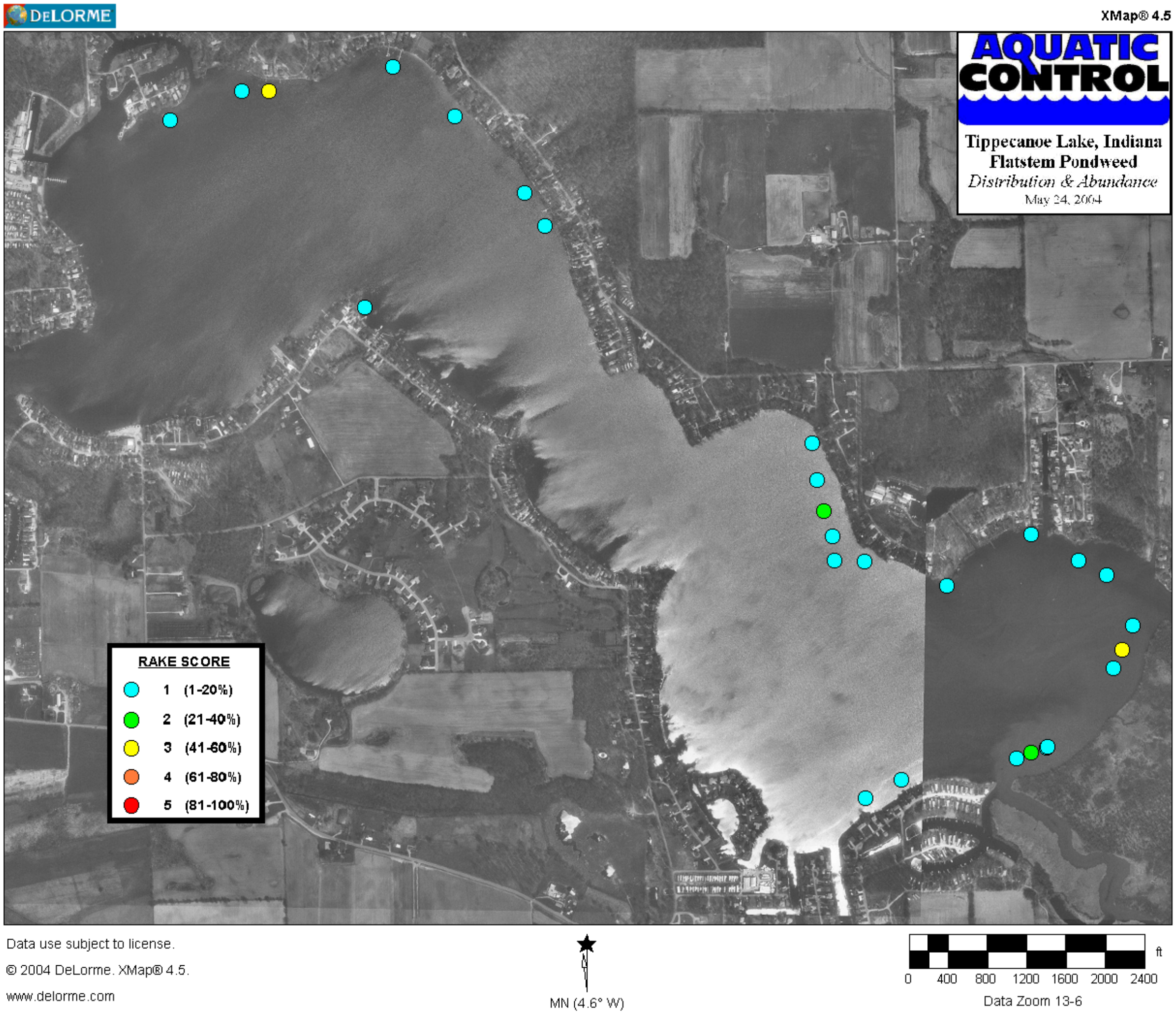
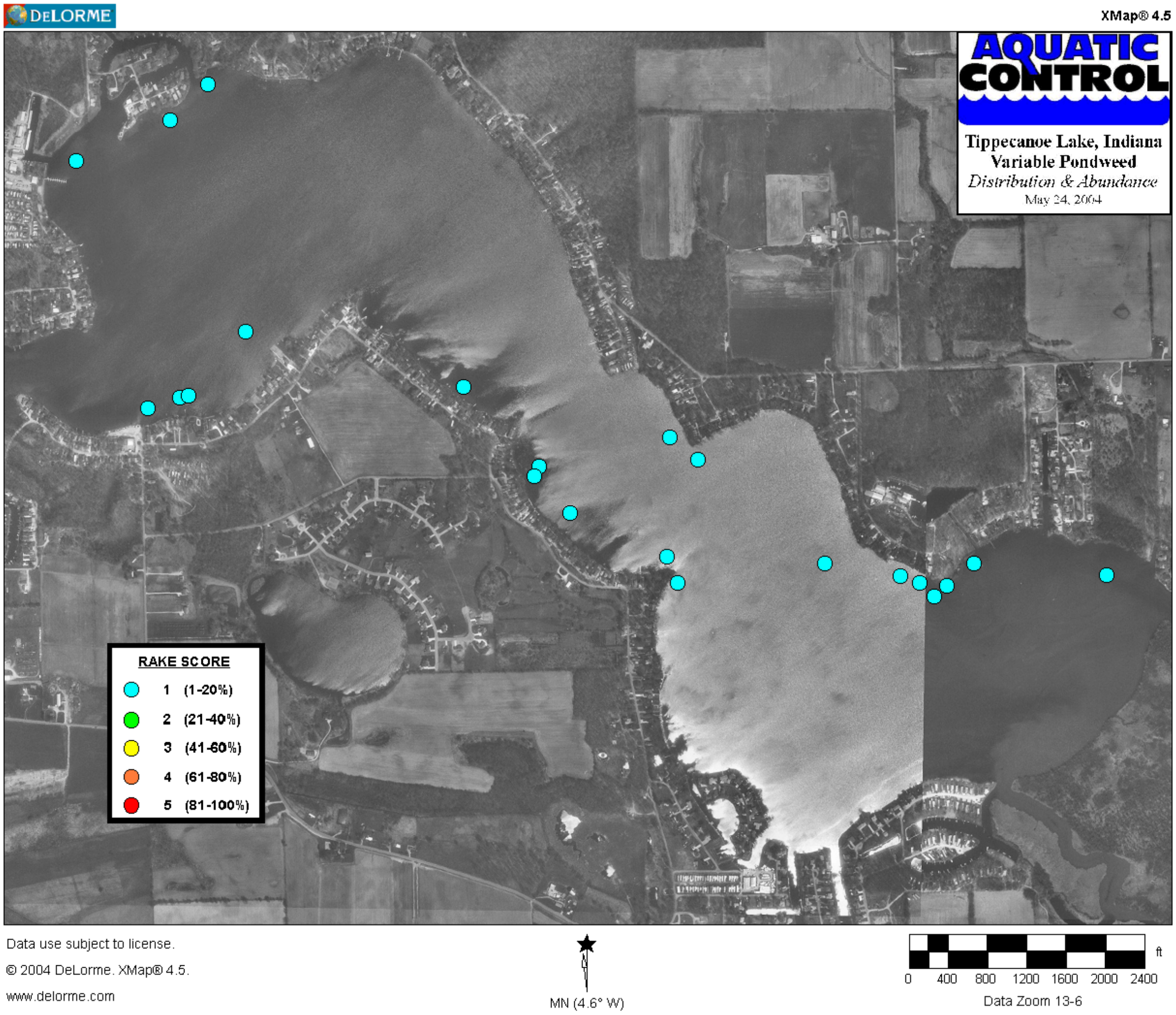
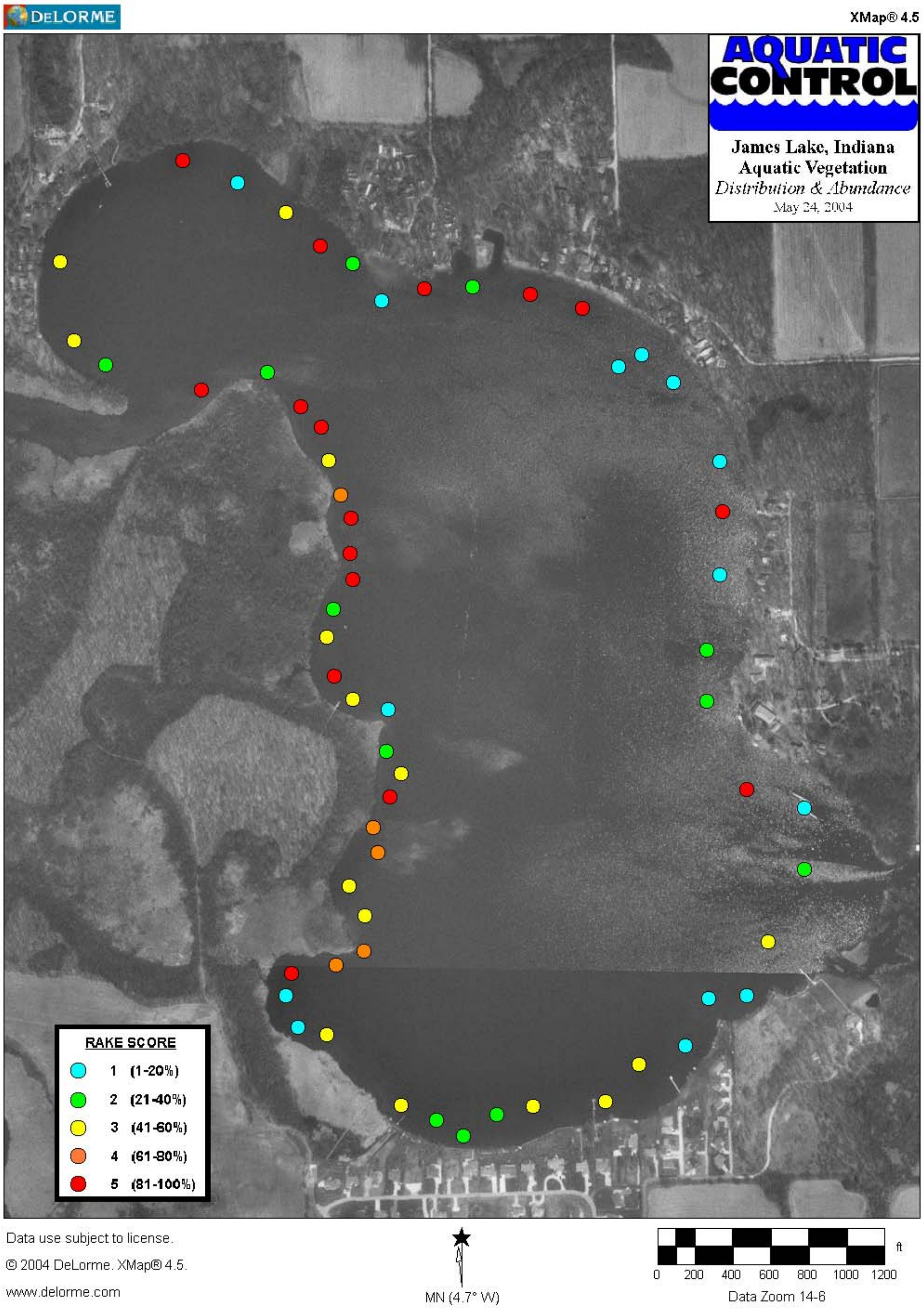
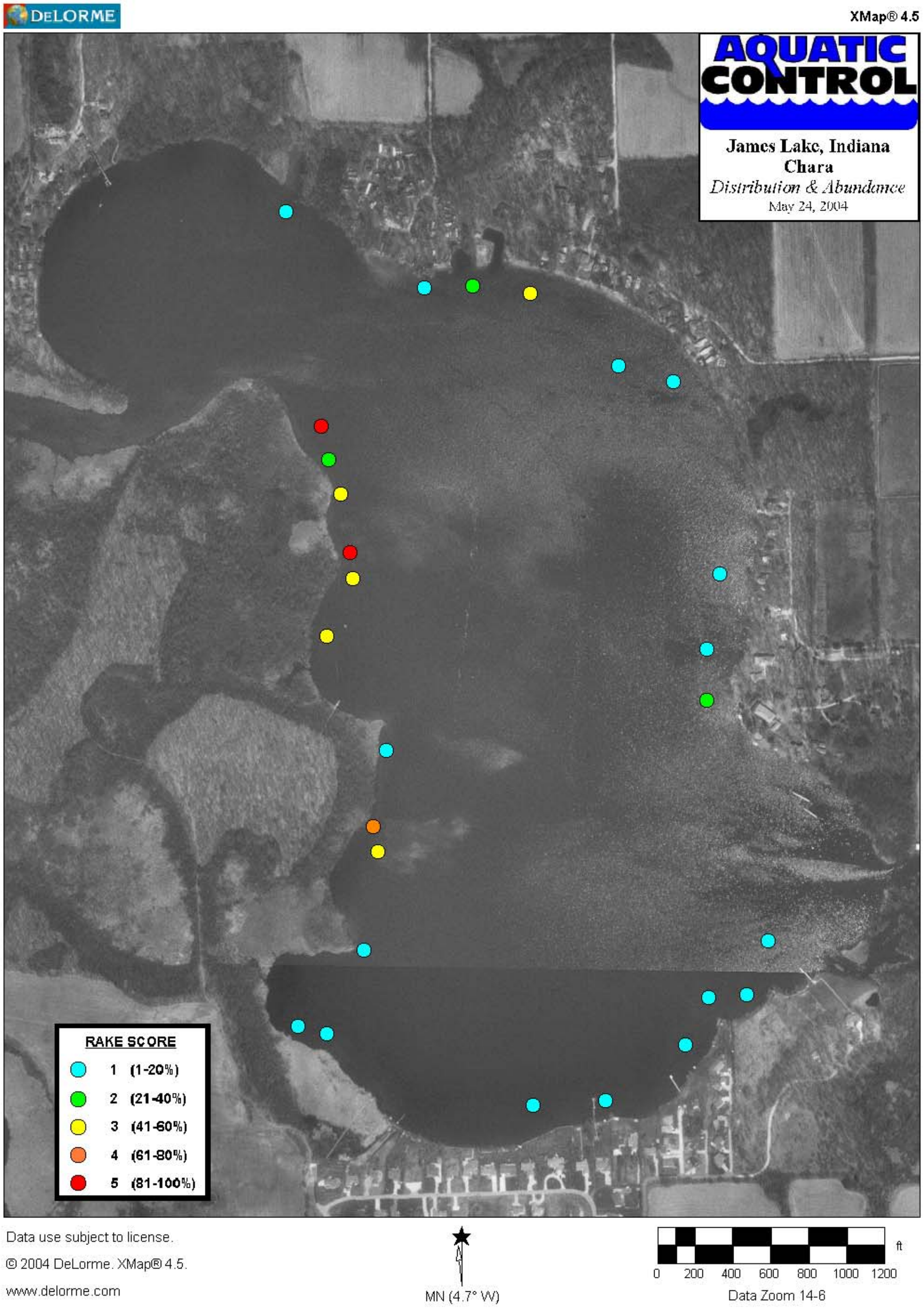

DeLORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Flatstem Pondweed
Distribution & Abundance
May 24, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 400 800 1200 1600 2000 2400 ft
Data Zoom 13-6


DeLORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Variable Pondweed
Distribution & Abundance
May 24, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 400 800 1200 1600 2000 2400 ft
Data Zoom 13-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Aquatic Vegetation
Distribution & Abundance
May 24, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.7° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Chara
Distribution & Abundance
May 24, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.7° W)
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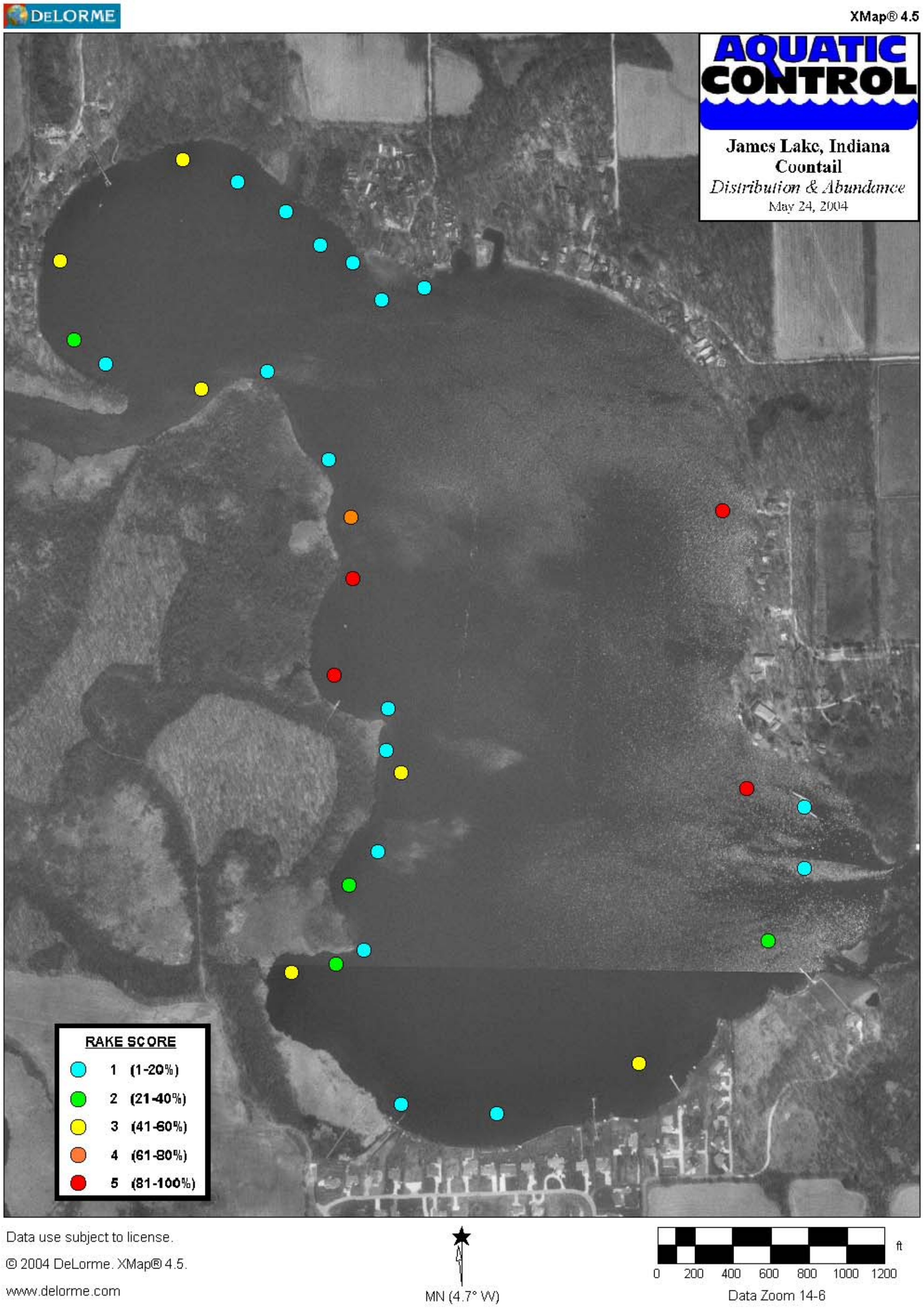
Data Zoom 14-6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XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Coontail
Distribution & Abundance
May 24, 2004
RAKE SCORE
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2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.7° W)
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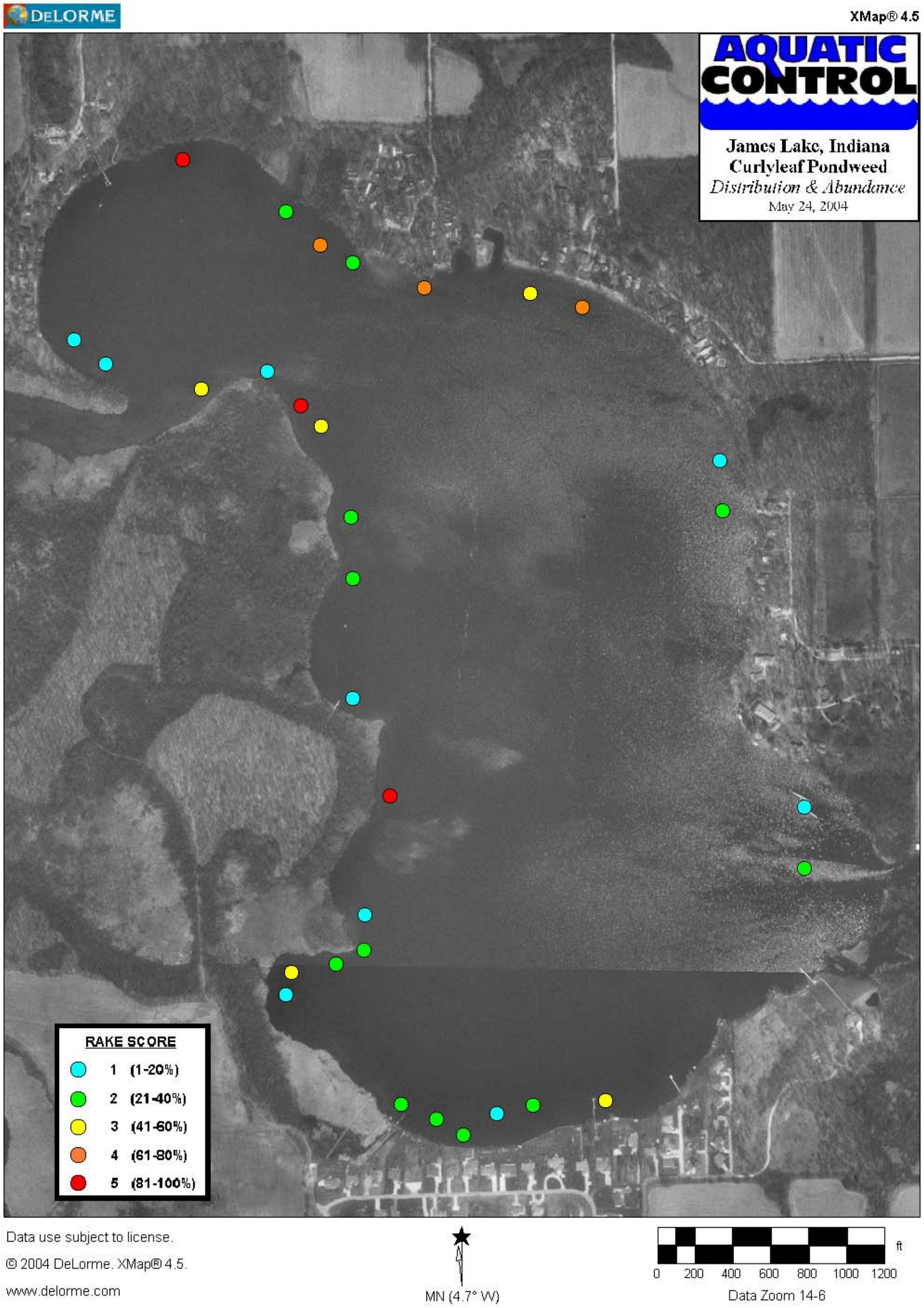
ft
Data Zoom 14-6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XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Curlyleaf Pondweed
Distribution & Abundance
May 24, 2004
RAKE SCORE
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2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.7° W)
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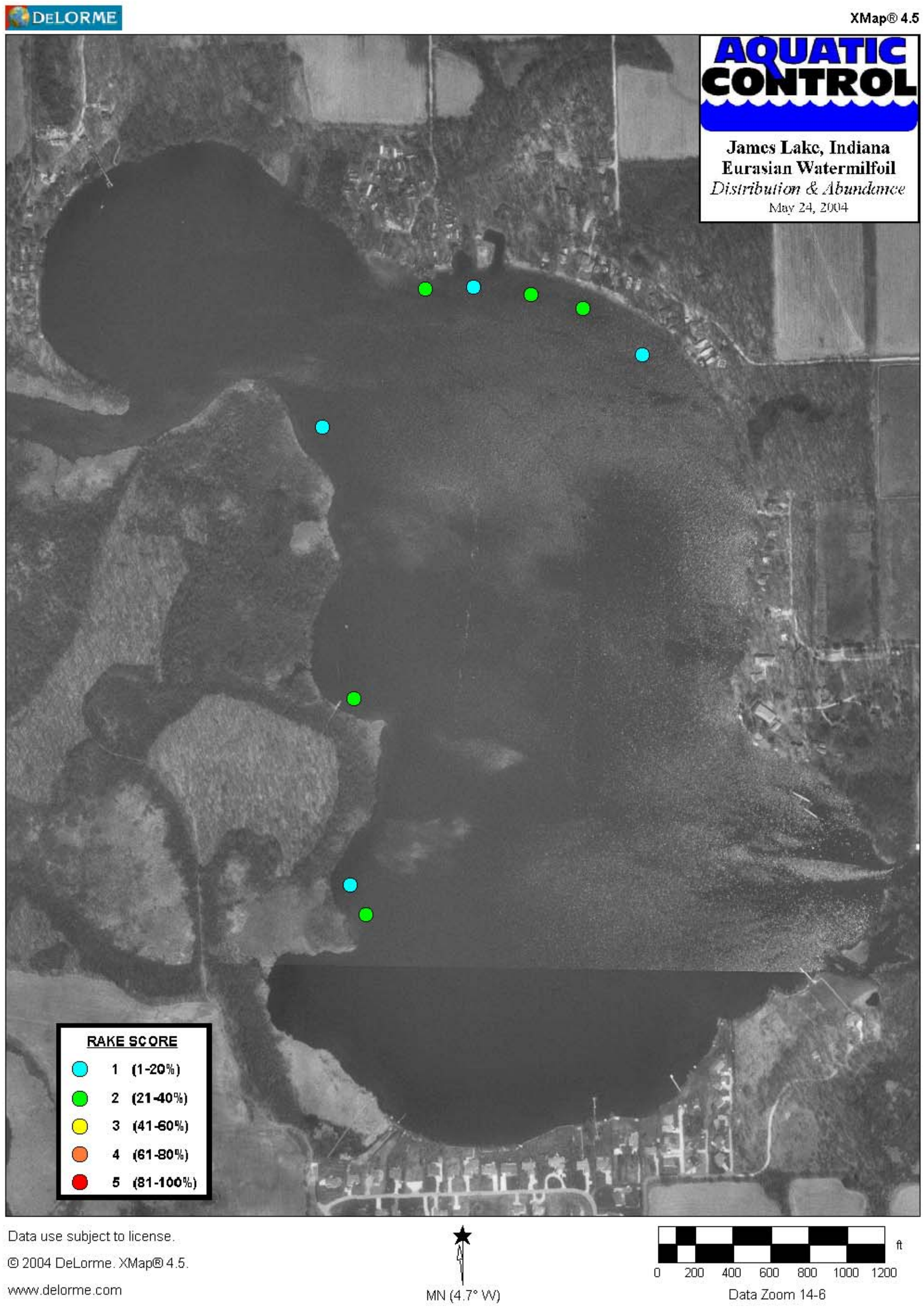
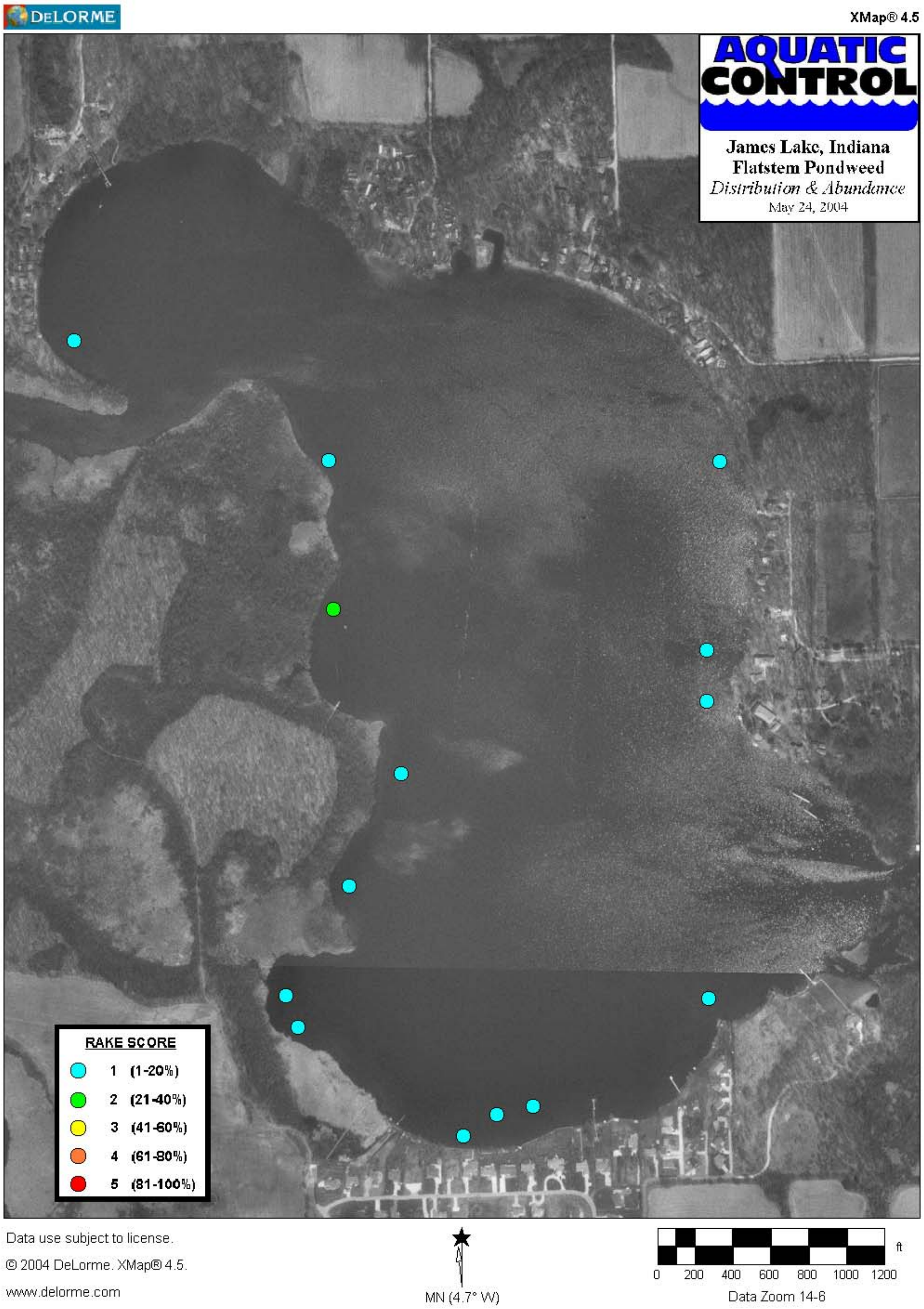
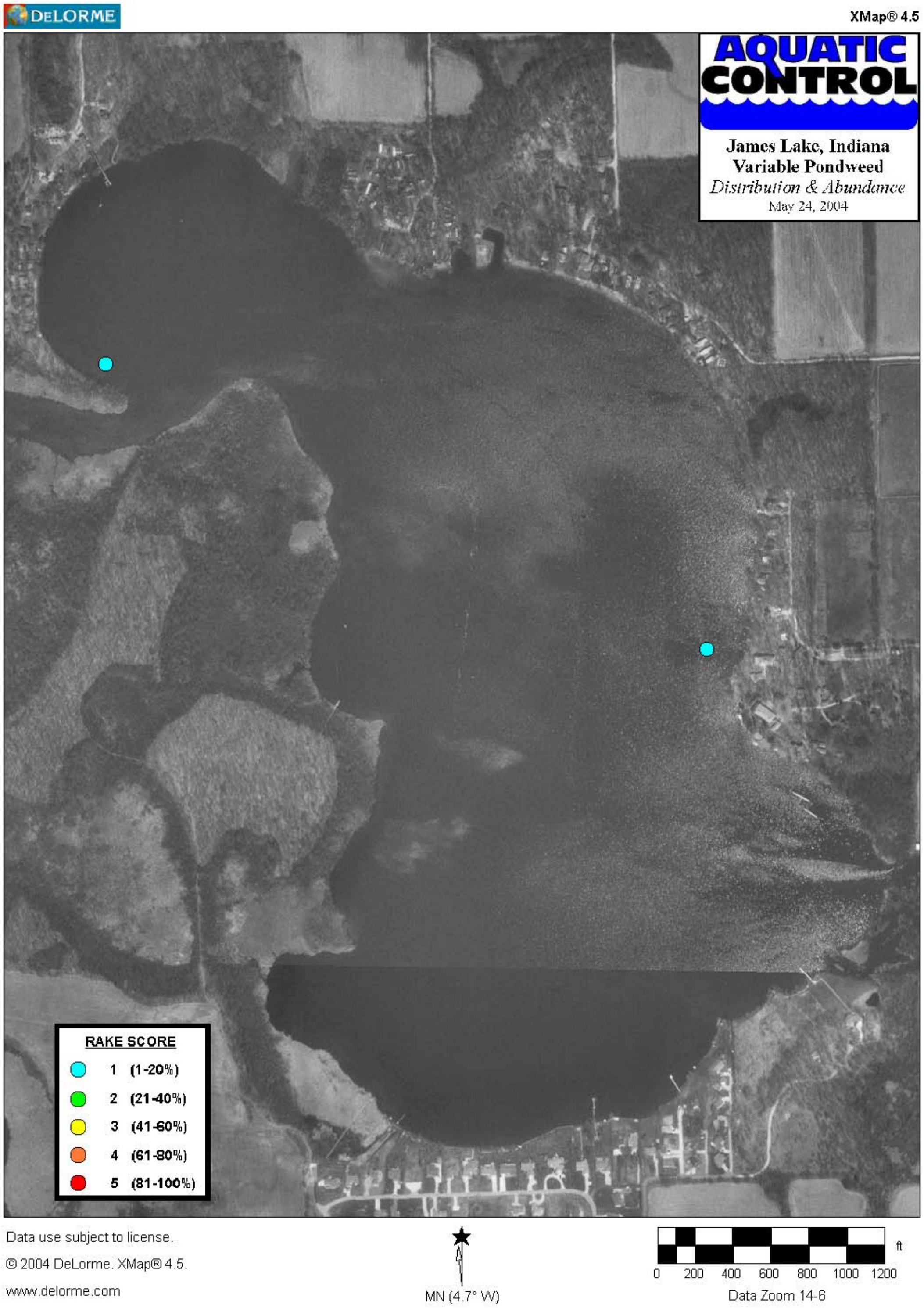
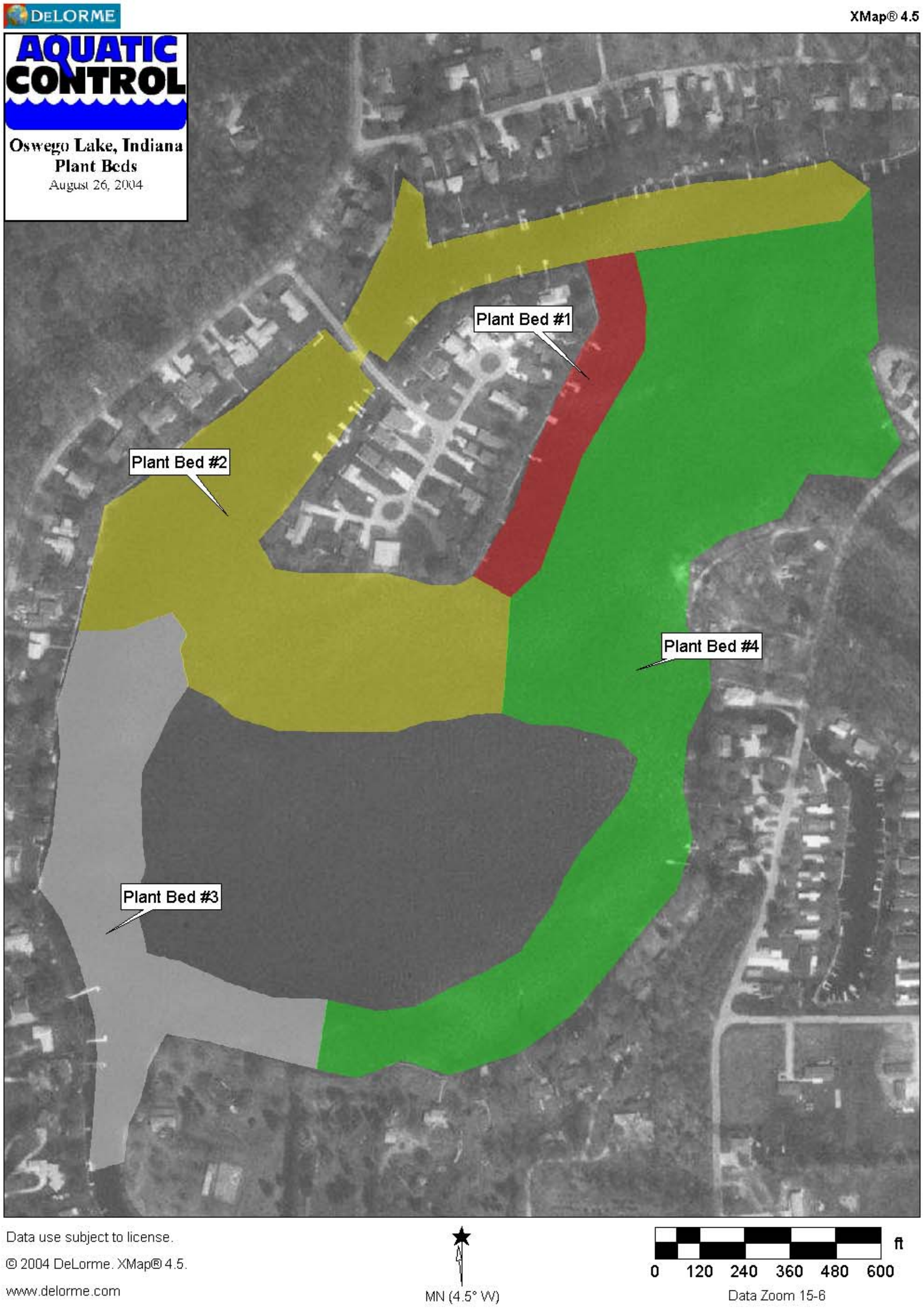
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Eurasian Watermilfoil
Distribution & Abundance
May 24, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.7° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Flatstem Pondweed
Distribution & Abundance
May 24, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.7° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Variable Pondweed
Distribution & Abundance
May 24, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.7° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Plant Beds
August 26, 2004
Plant Bed #1
Plant Bed #2
Plant Bed #3
Plant Bed #4
Data use subject to license.
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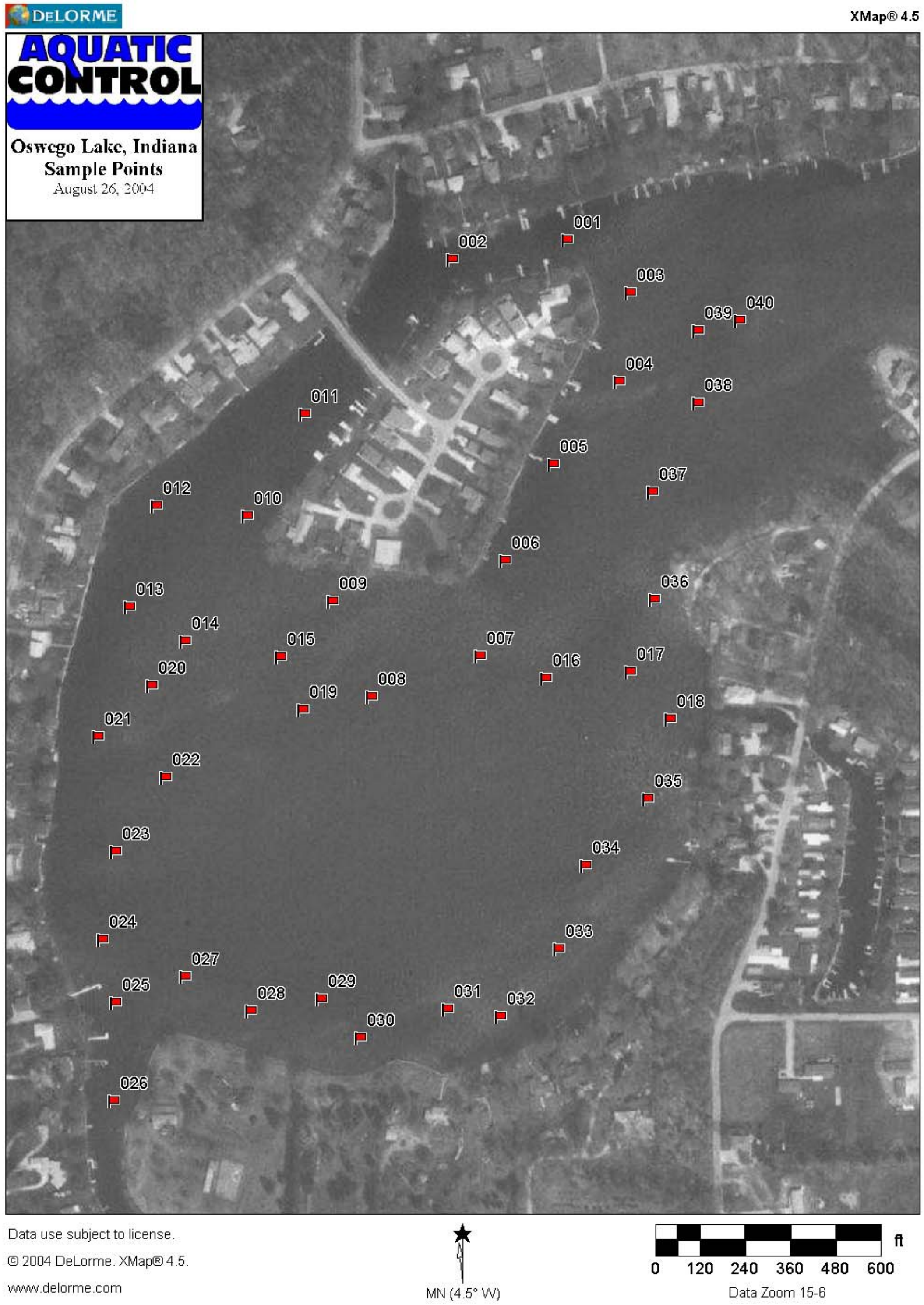
www.delorme.com
MN (4.5° W)
ft
0 120 240 360 480 600
Data Zoom 15-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Sample Points
August 26, 2004
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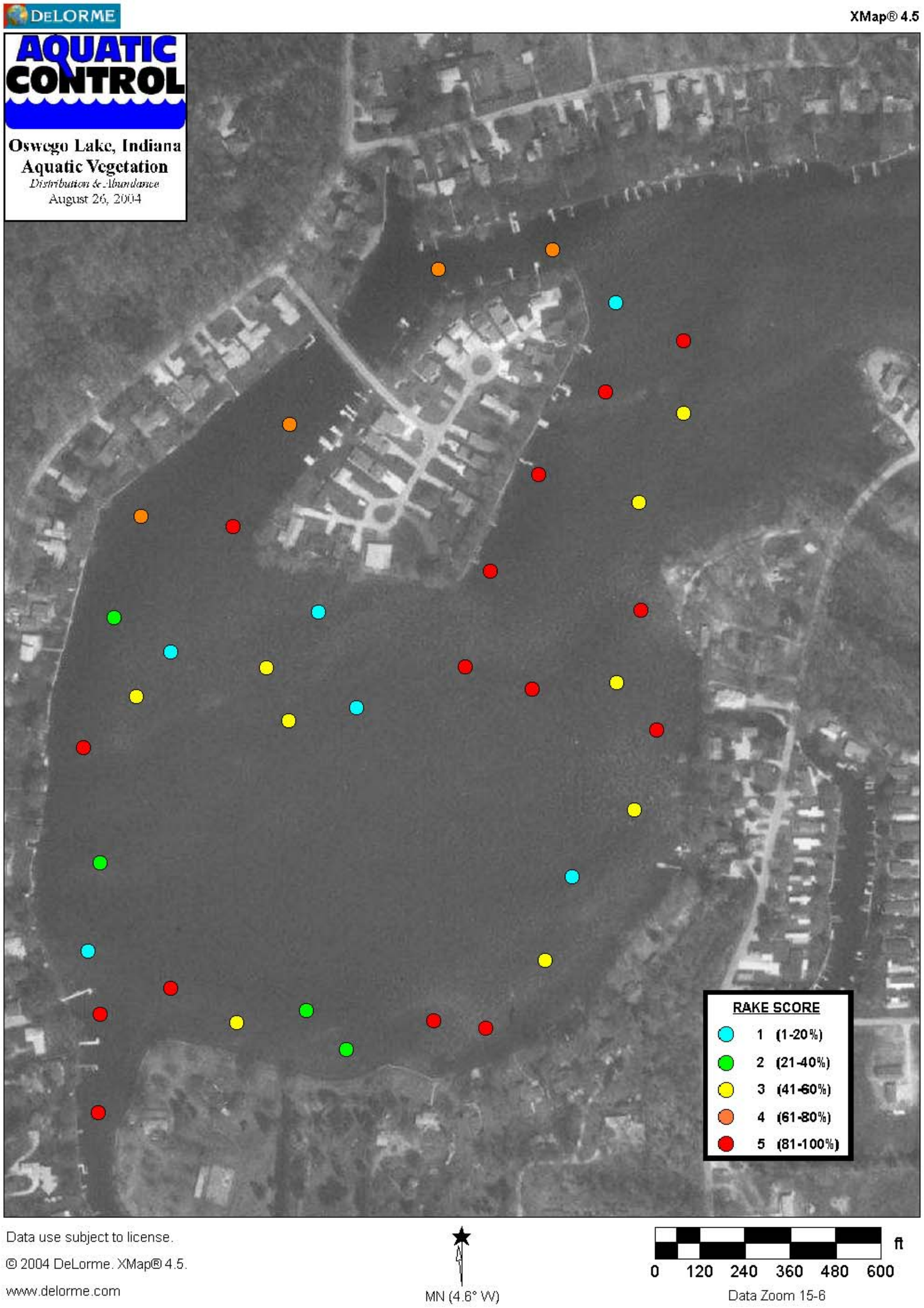
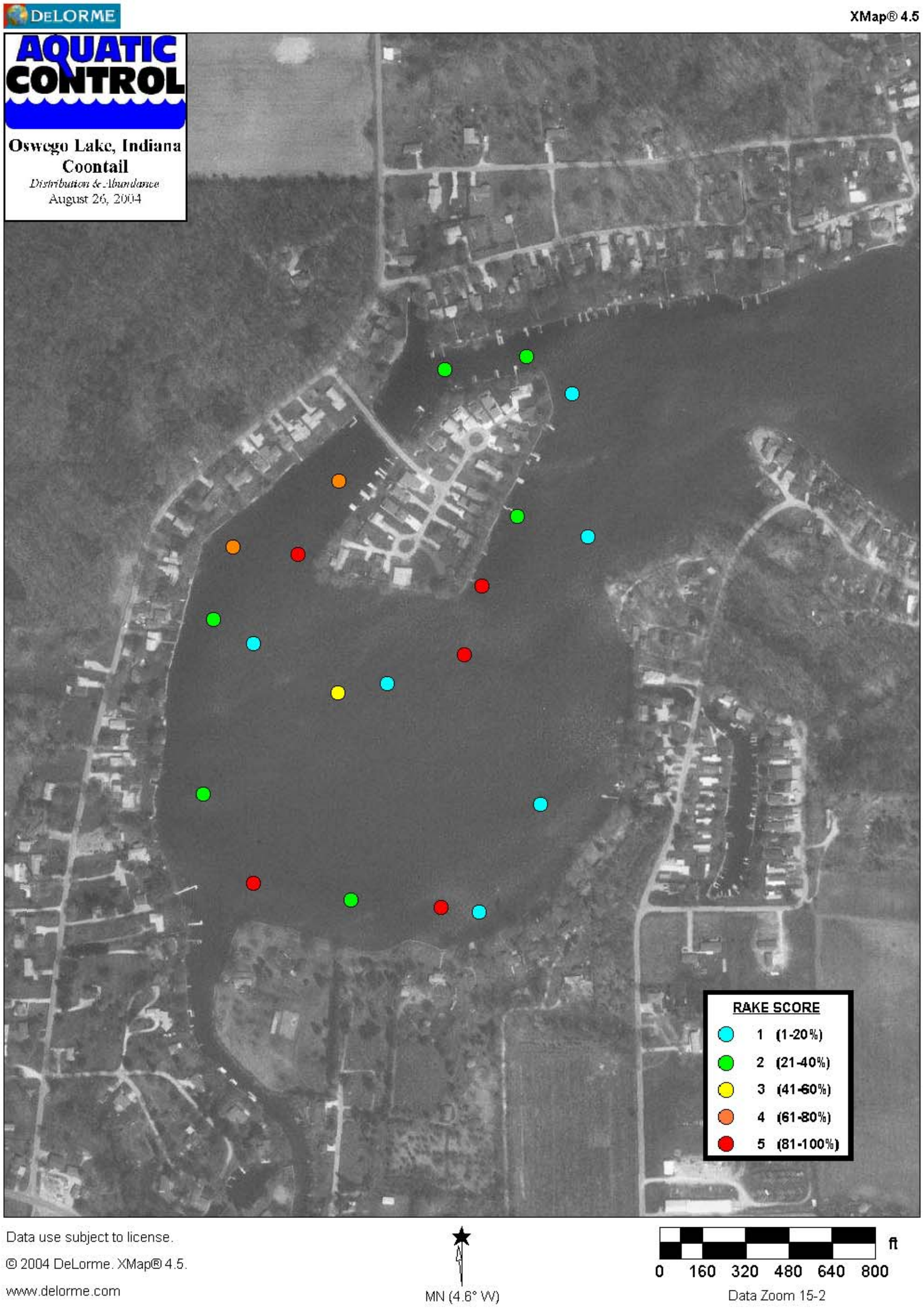
www.delorme.com
MN (4.5° W)
0 120 240 360 480 600 ft
Data Zoom 15-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Aquatic Vegetation
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 120 240 360 480 600 ft
Data Zoom 15-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Coontail
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
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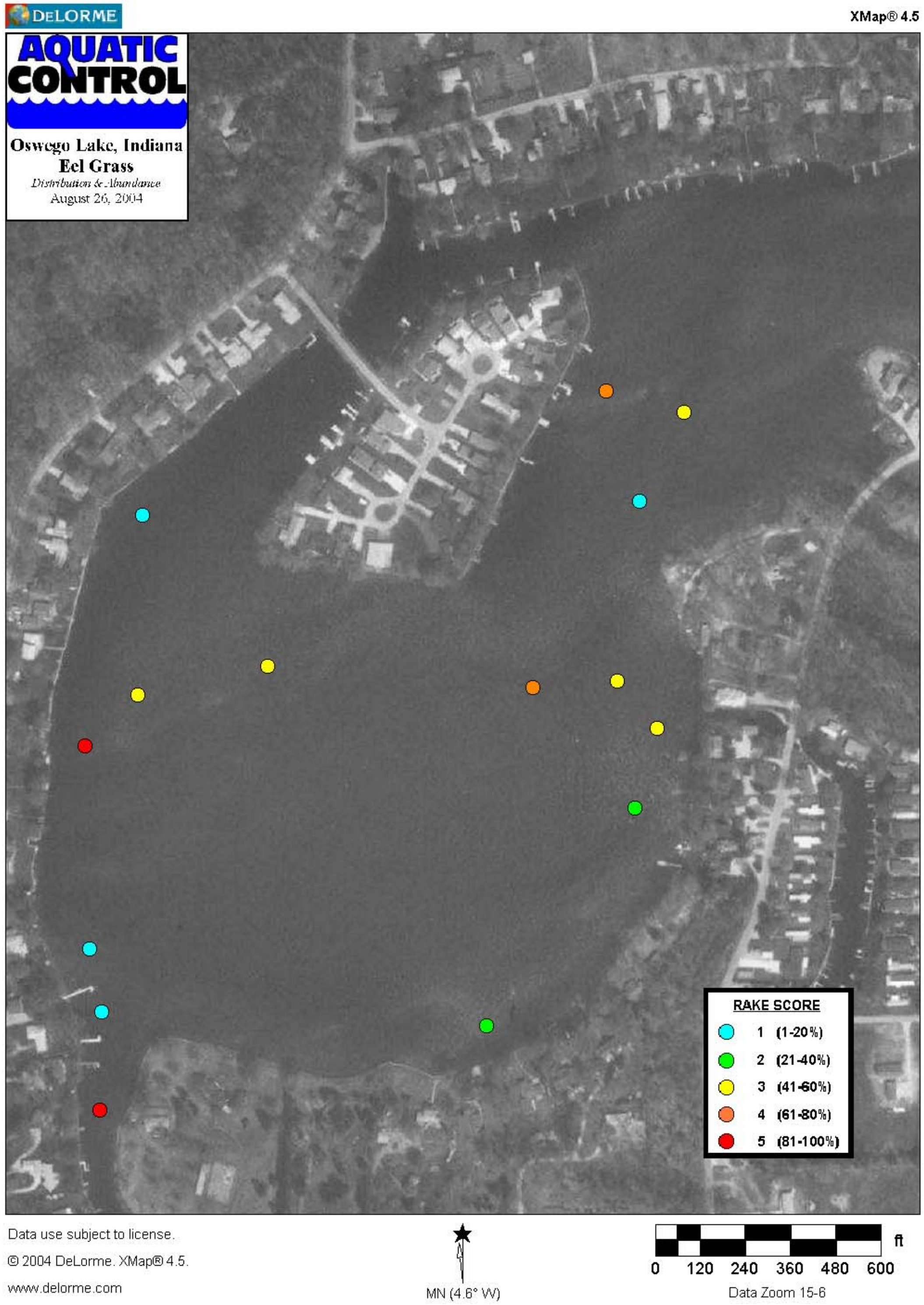
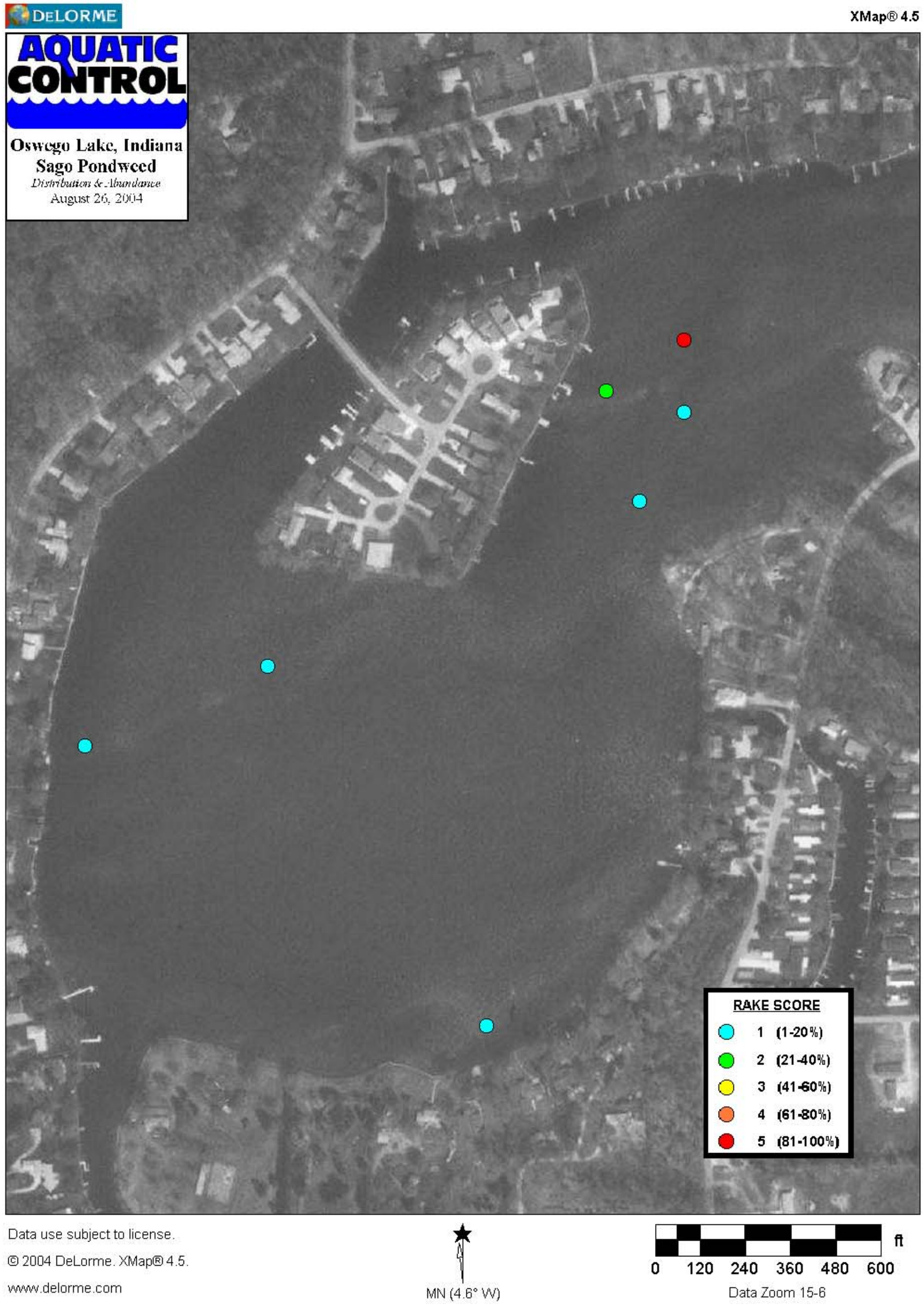
www.delorme.com
MN (4.6° W)
ft
0 160 320 480 640 800
Data Zoom 15-2


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Eel Grass
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 120 240 360 480 600 ft
Data Zoom 15-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Sago Pondweed
Distribution & Abundance
August 26, 2004
RAKE SCORE
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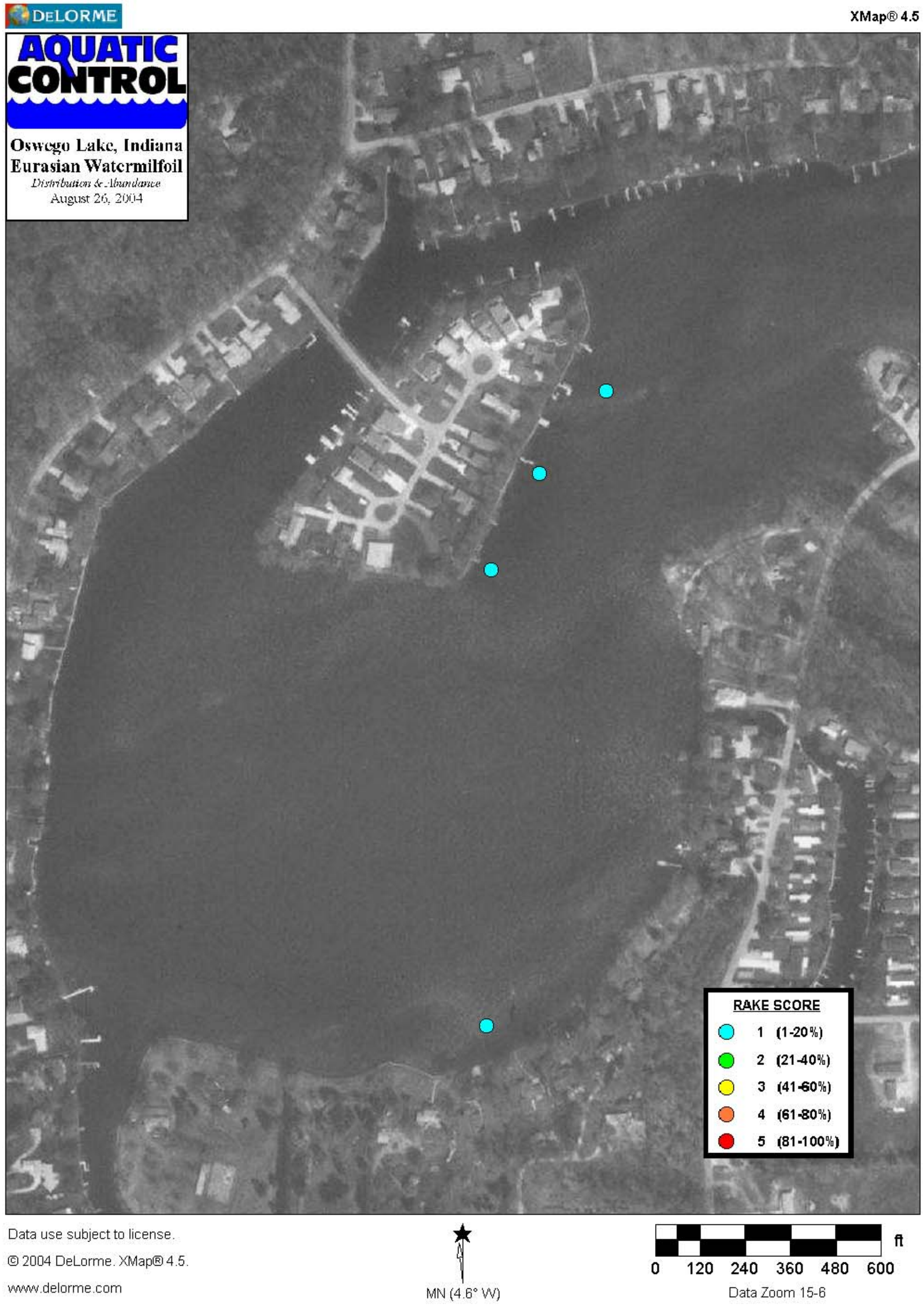
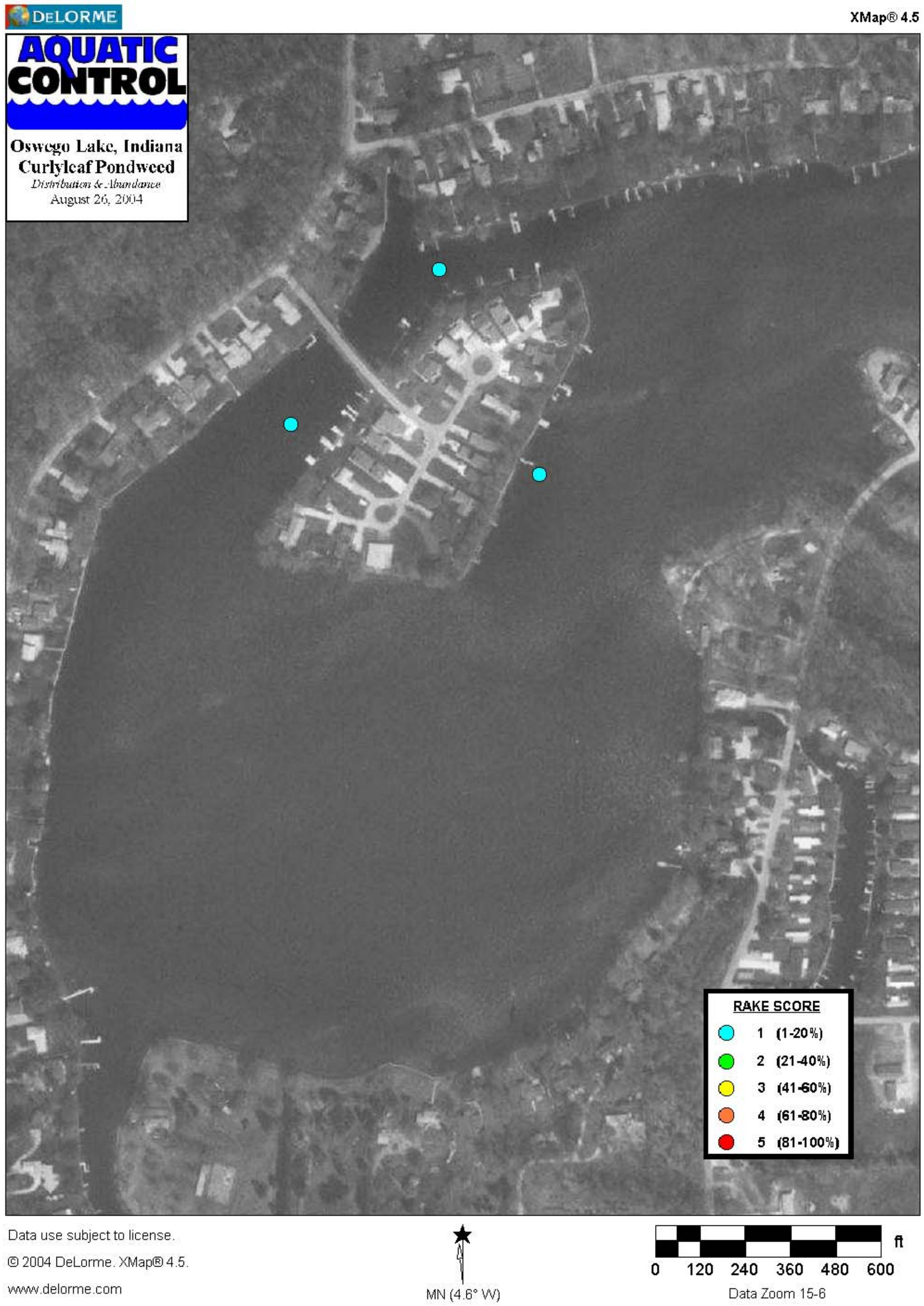
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
ft
0 120 240 360 480 600
Data Zoom 15-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Eurasian Watermilfoil
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
ft
0 120 240 360 480 600
Data Zoom 15-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Oswego Lake, Indiana
Curlyleaf Pondweed
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
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www.delorme.com
MN (4.6° W)
ft
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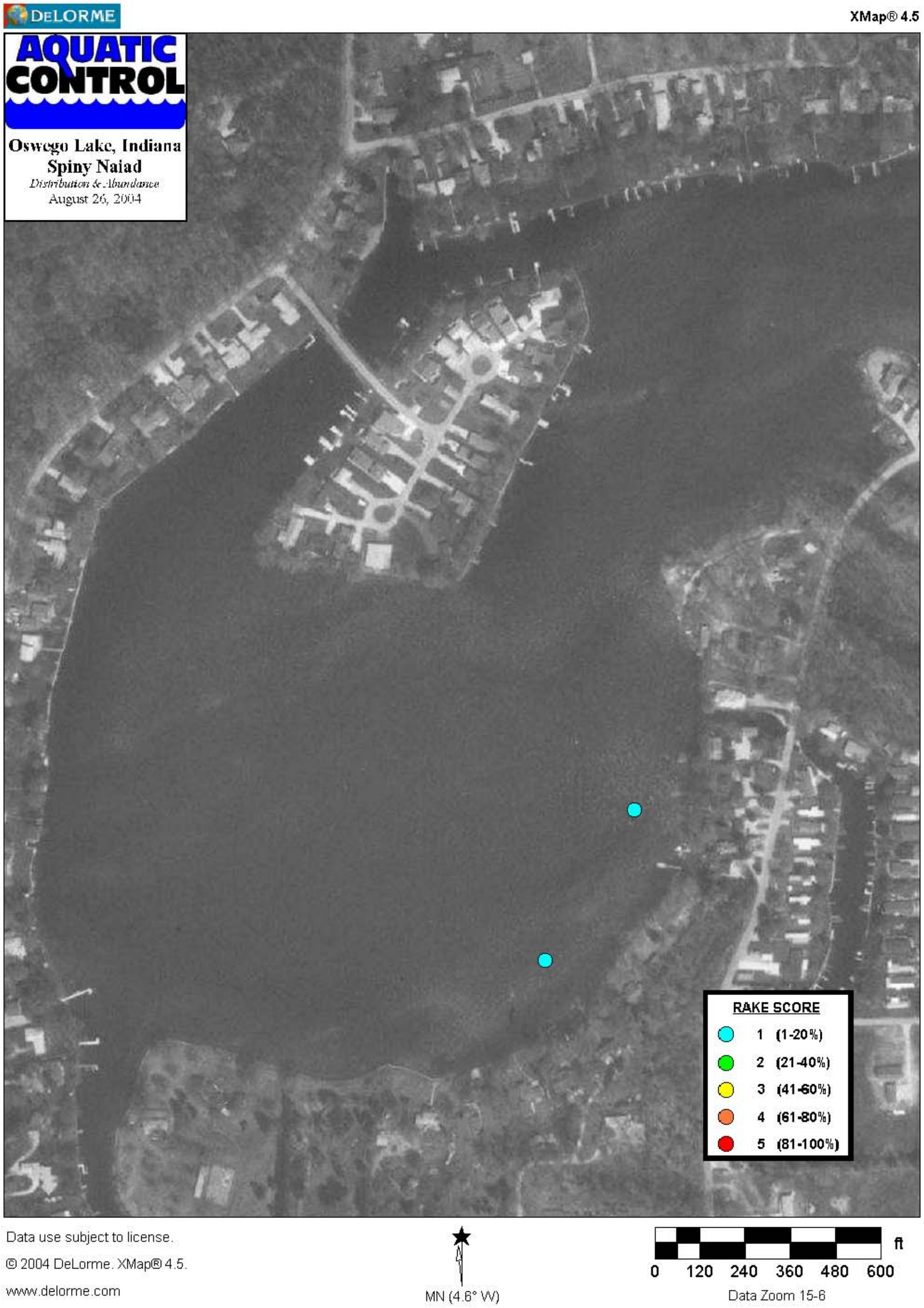
Data Zoom 15-6


DELORME
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AQUATIC CONTROL
Oswego Lake, Indiana
Spiny Naiad
Distribution & Abundance
August 26, 2004
RAKE SCORE
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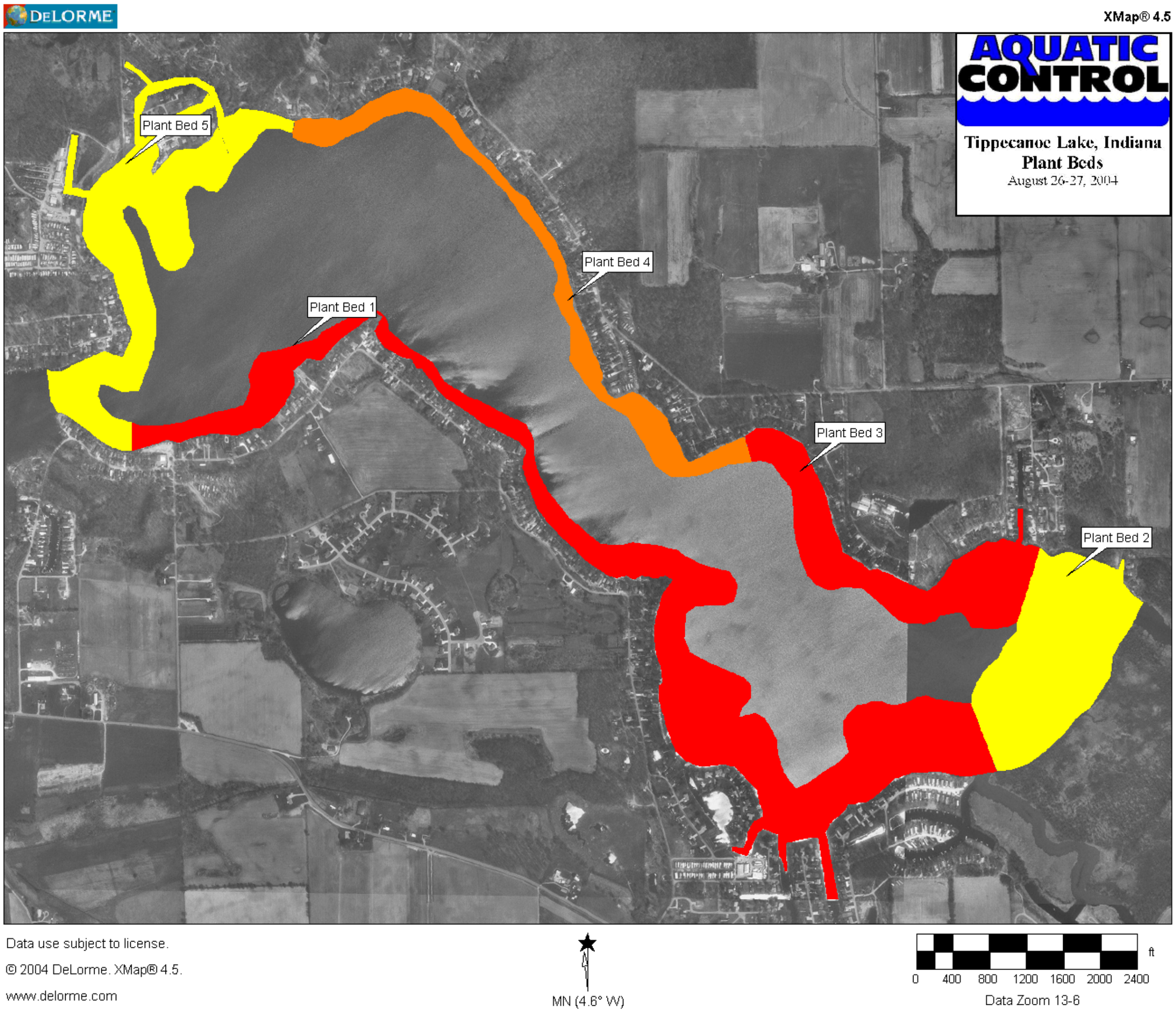
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 120 240 360 480 600 ft
Data Zoom 15-6


DeLORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Plant Beds
August 26-27, 2004
Plant Bed 5
Plant Bed 4
Plant Bed 1
Plant Bed 3
Plant Bed 2
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www.delorme.com
MN (4.6° W)
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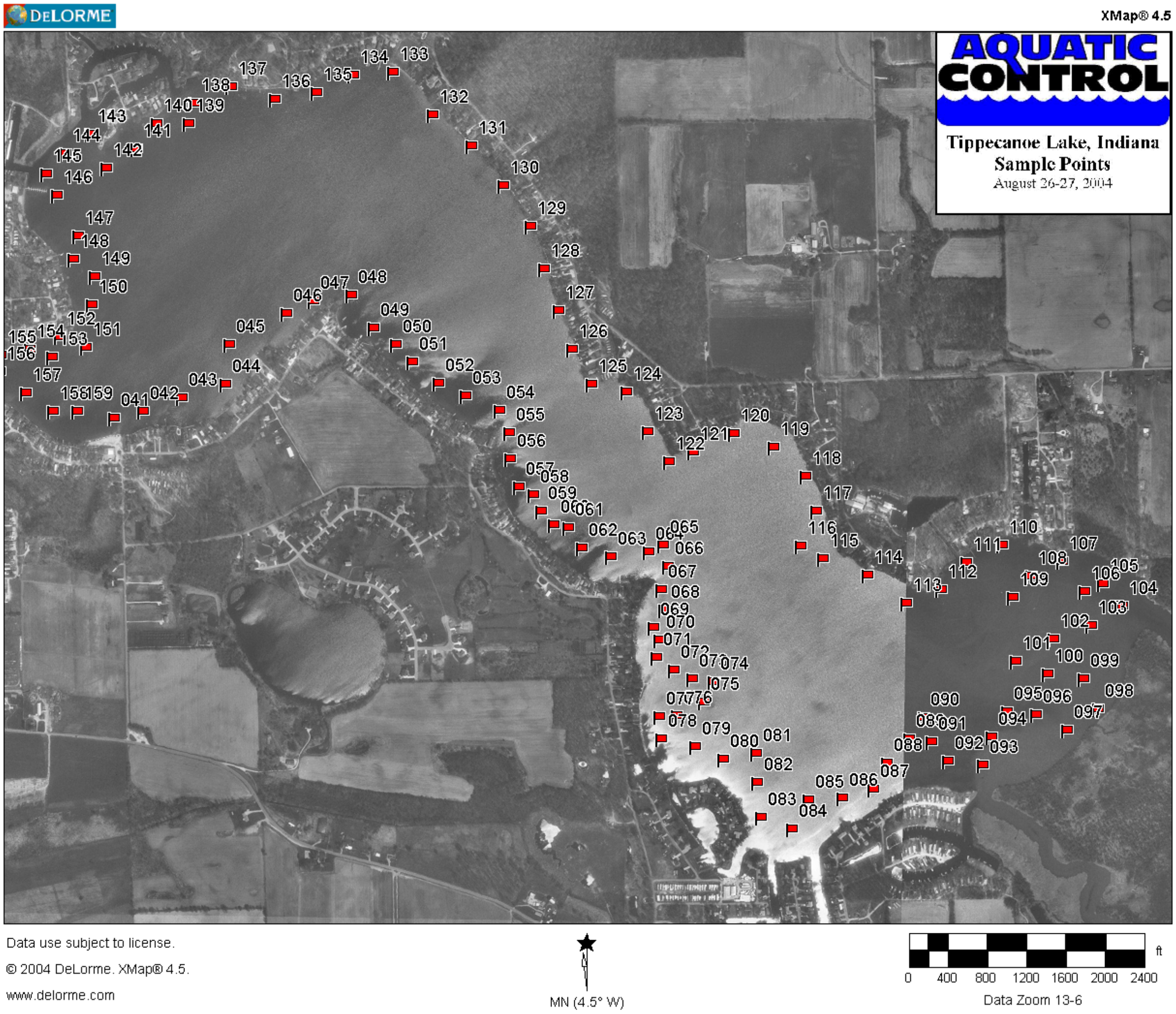
ft
Data Zoom 13-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Sample Points
August 26-27, 2004
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.5° W)
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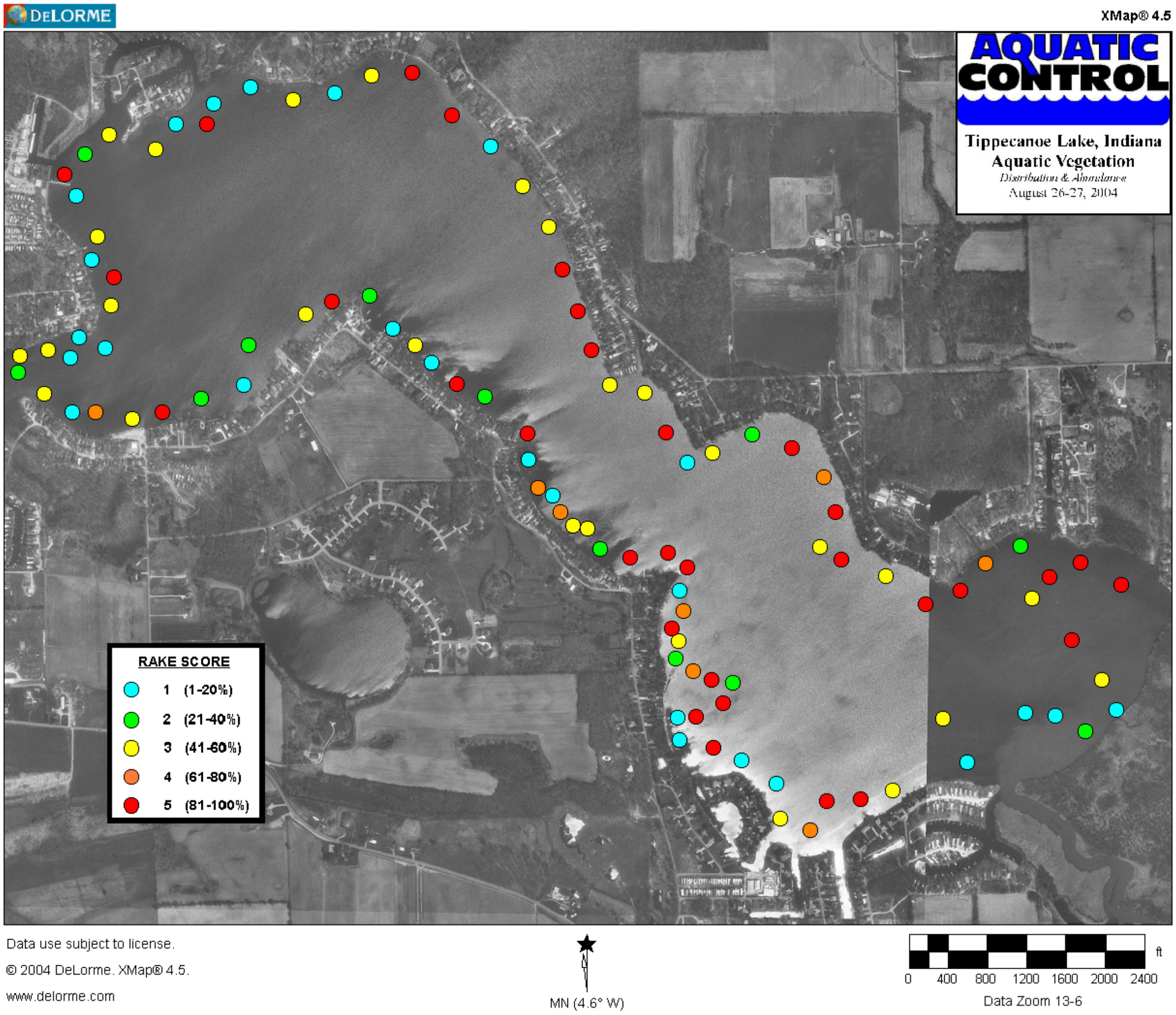
Data Zoom 13-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Aquatic Vegetation
Distribution & Abundance
August 26-27, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
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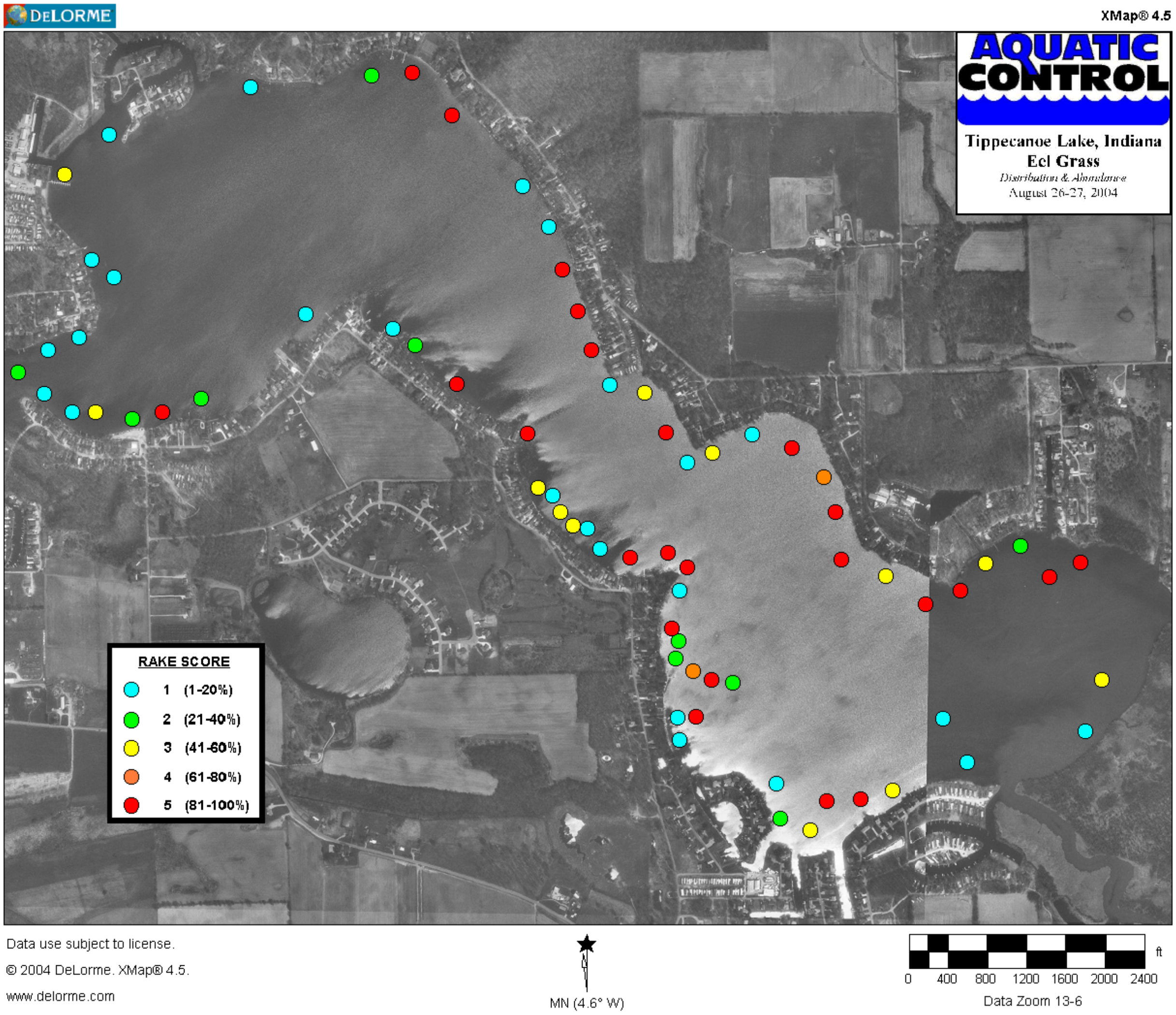
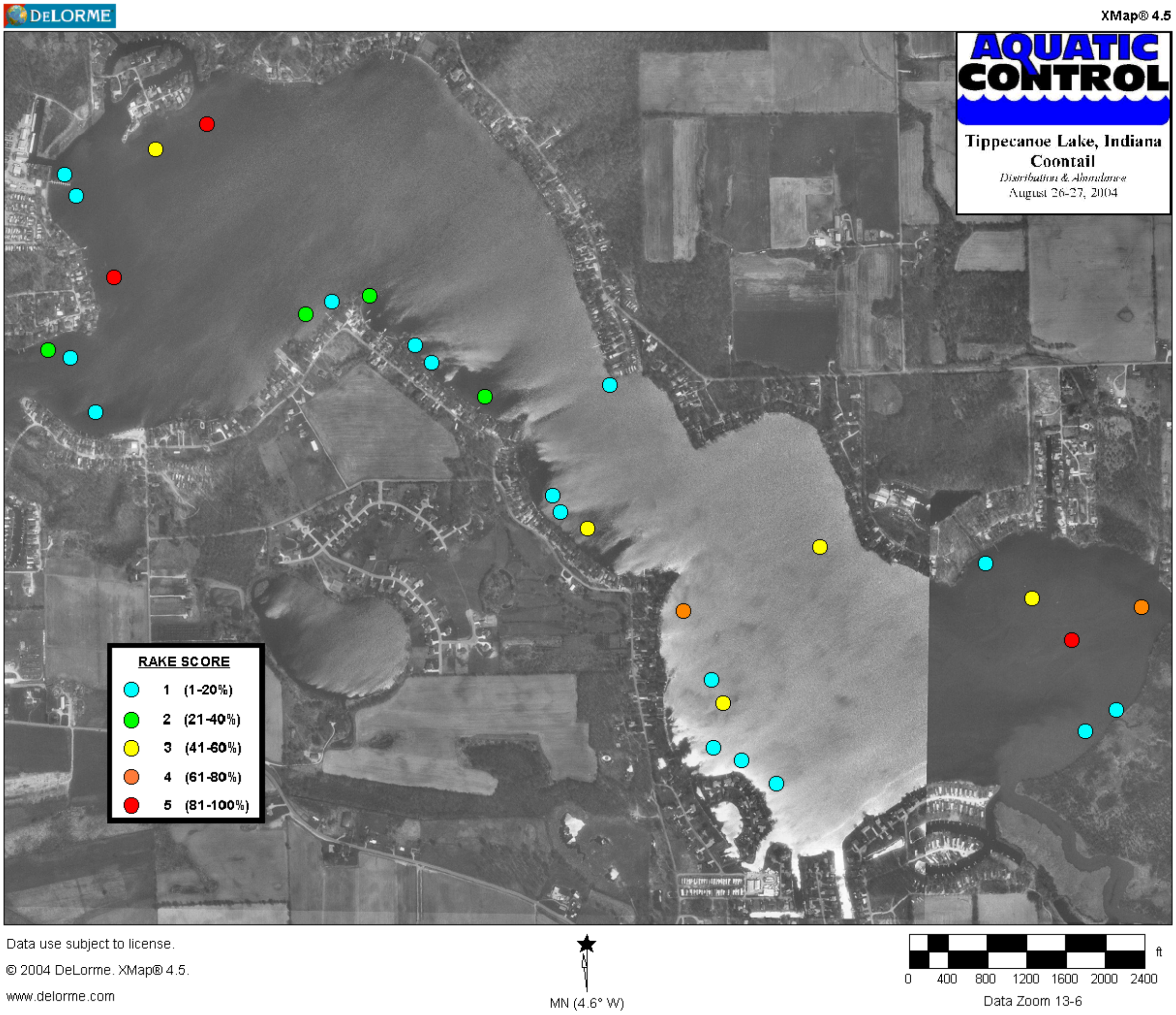
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 400 800 1200 1600 2000 2400 ft
Data Zoom 13-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Eel Grass
Distribution & Abundance
August 26-27, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 400 800 1200 1600 2000 2400 ft
Data Zoom 13-6


DeLORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Coontail
Distribution & Abundance
August 26-27, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
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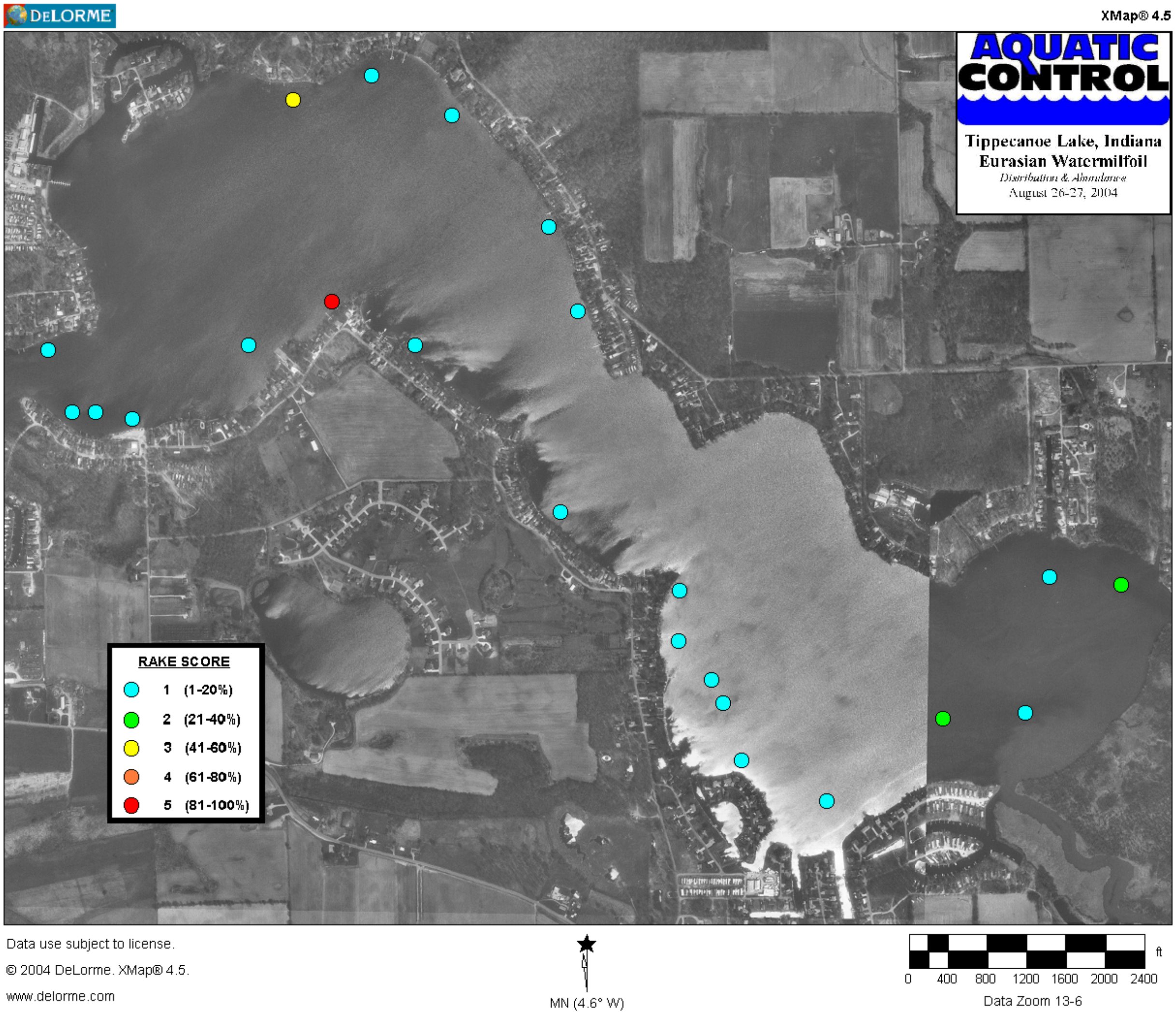
Data Zoom 13-6


DeLORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Eurasian Watermilfoil
Distribution & Abundance
August 26-27, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
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4 (61-80%)
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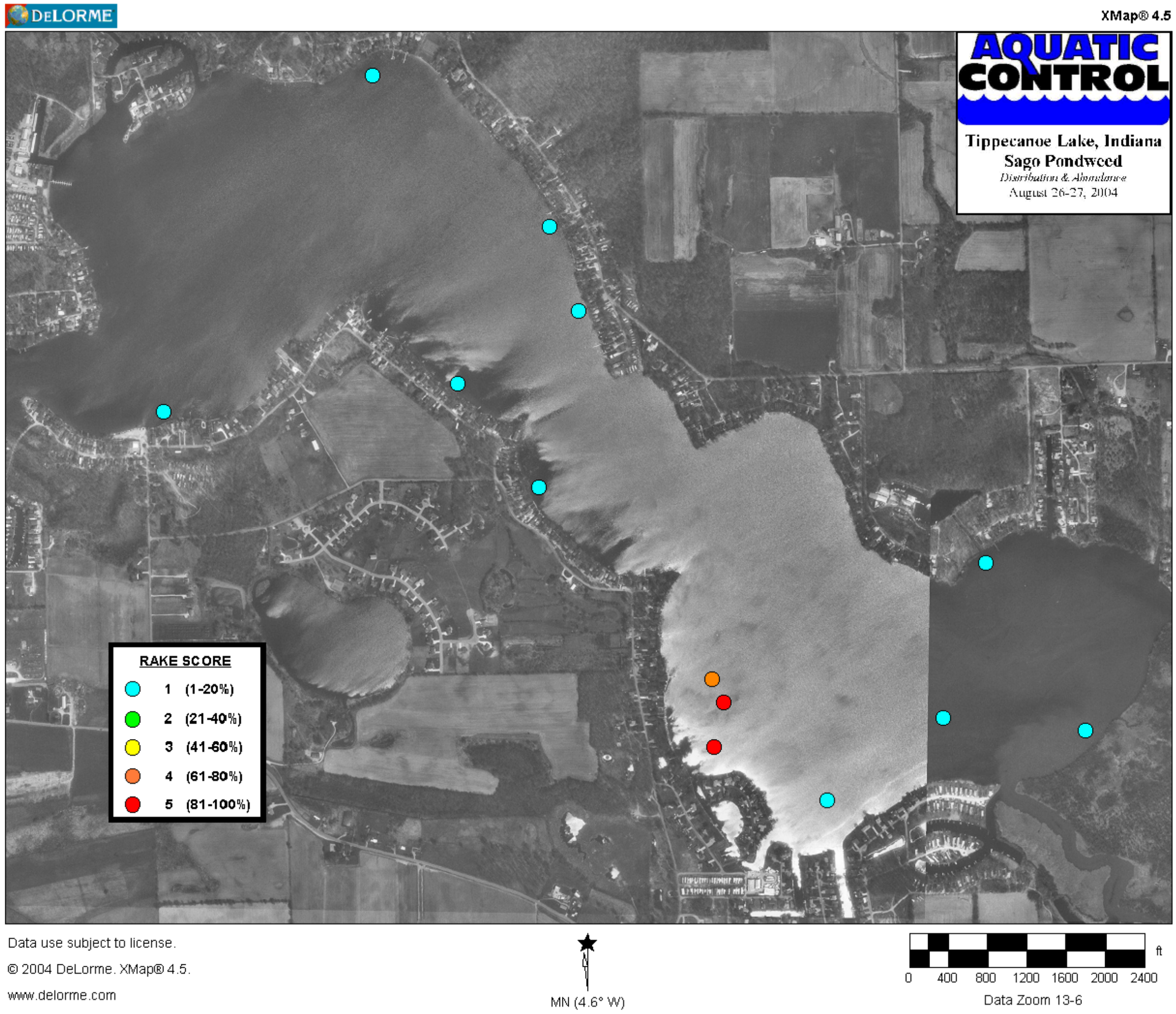
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 400 800 1200 1600 2000 2400 ft
Data Zoom 13-6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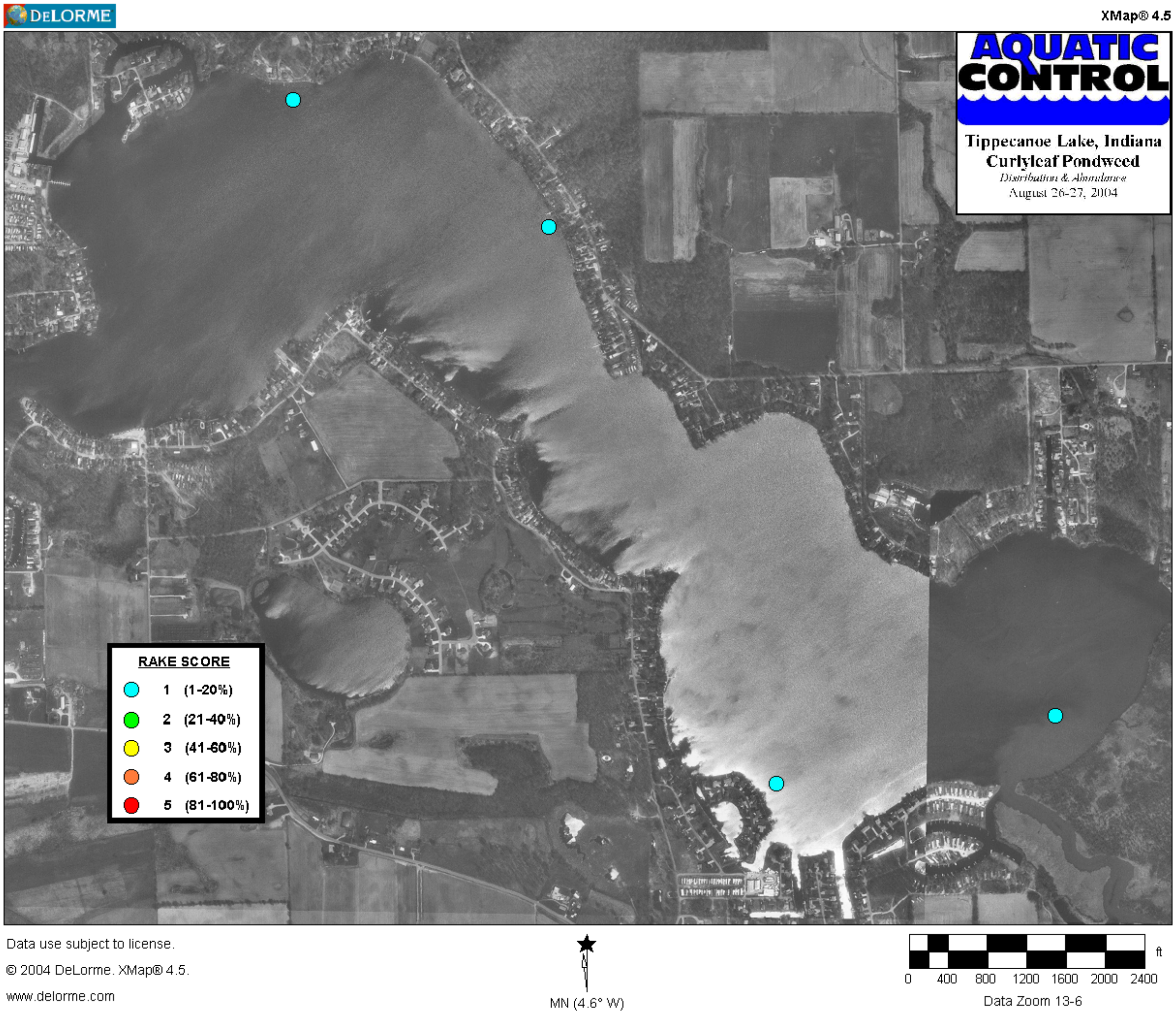
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Sago Pondweed
Distribution & Abundance
August 26-27, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 400 800 1200 1600 2000 2400
ft
Data Zoom 13-6


DELORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
Curlyleaf Pondweed
Distribution & Abundance
August 26-27, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
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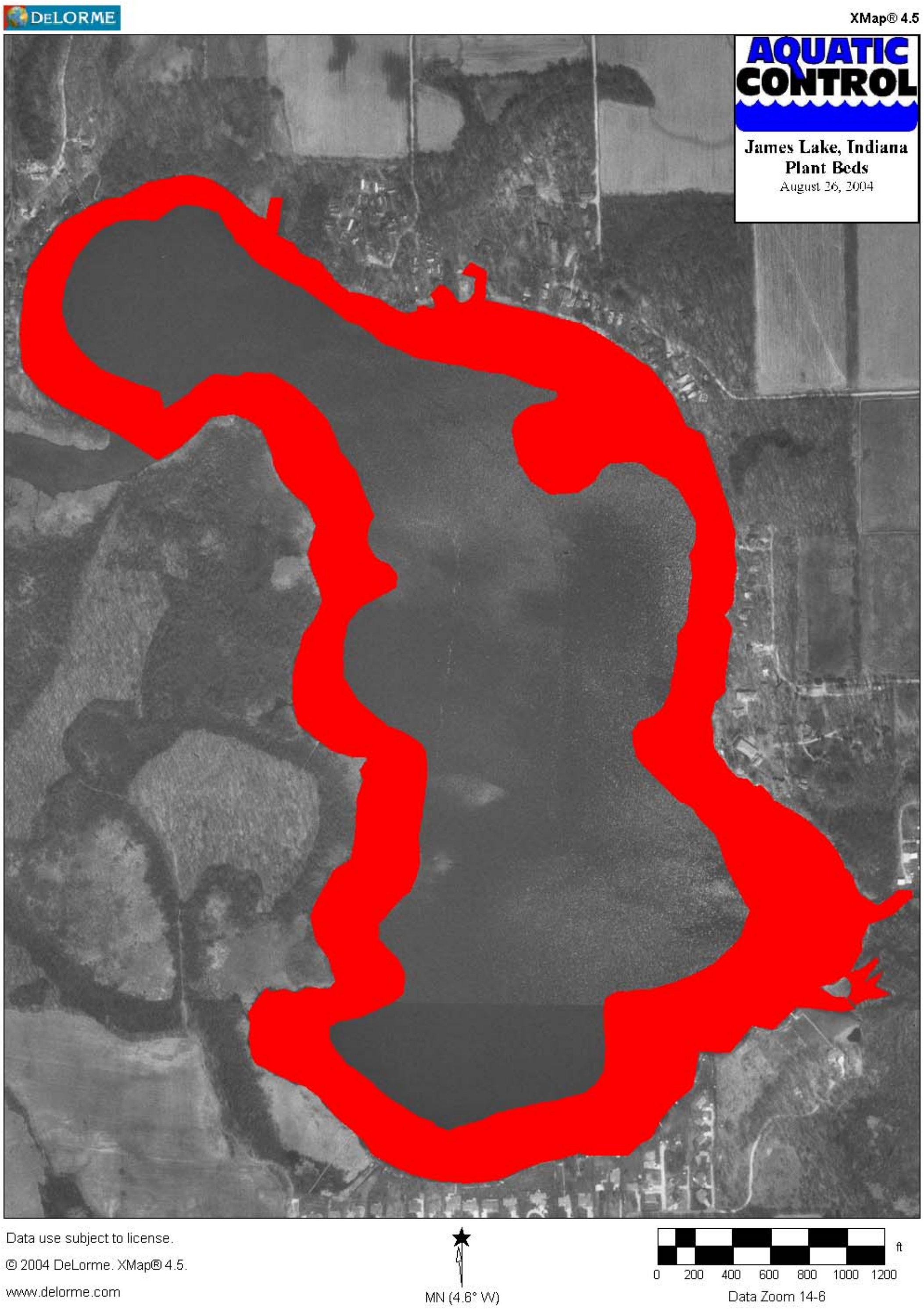
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 400 800 1200 1600 2000 2400 ft
Data Zoom 13-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Plant Beds
August 26, 2004
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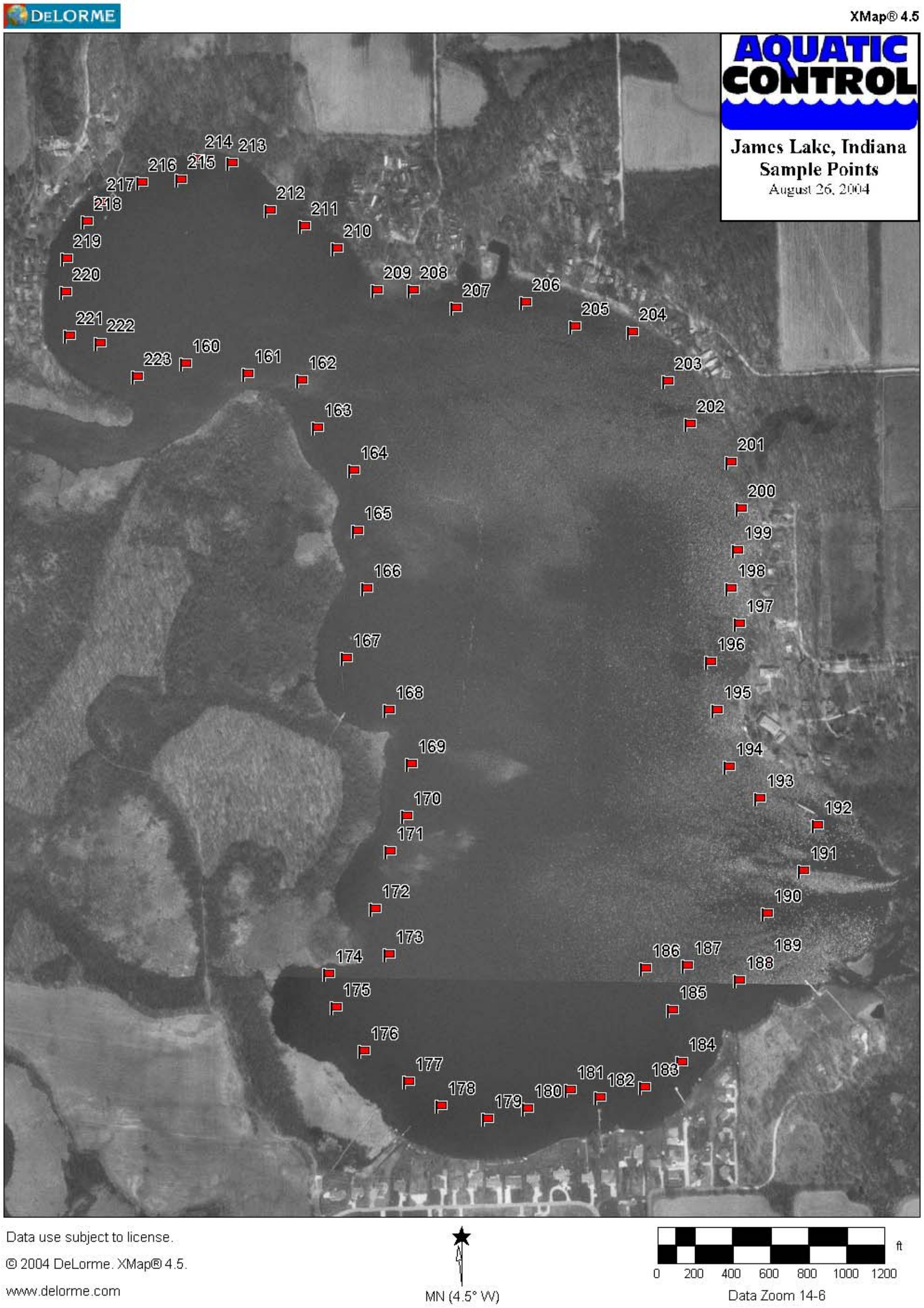
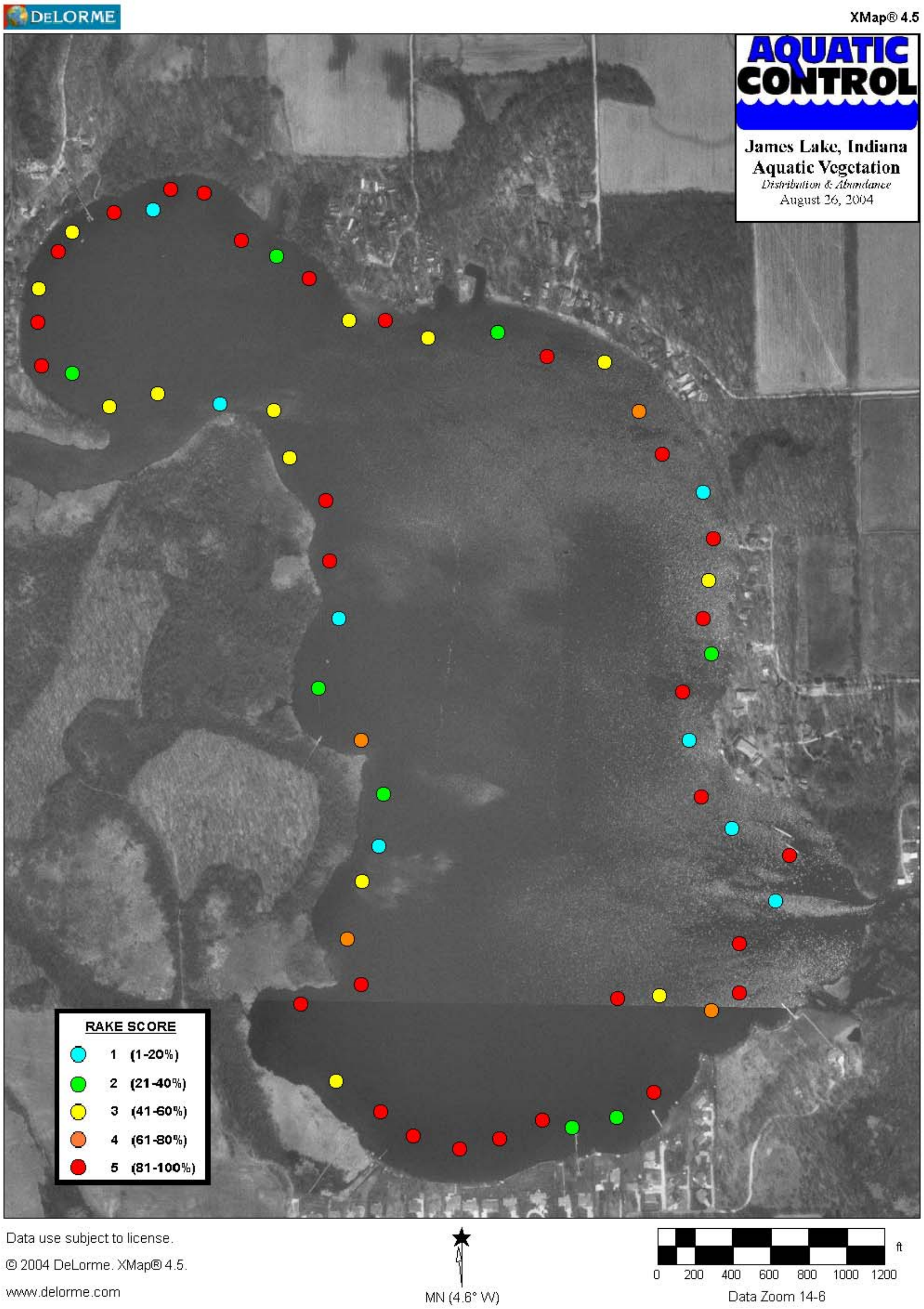
www.delorme.com
MN (4.6° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Sample Points
August 26, 2004
214 213 216 215 217 218 212 211 210 219 220 209 208 207 206 205 204 221 222 223 160 161 162 203 163 202 201 164 200 165 199 166 198 197 167 196 168 195 169 194 193 192 170 171 191 172 190 173 189 174 186 187 188 175 185 176 184 177 183 181 182 178 179 180
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.5° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Aquatic Vegetation
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
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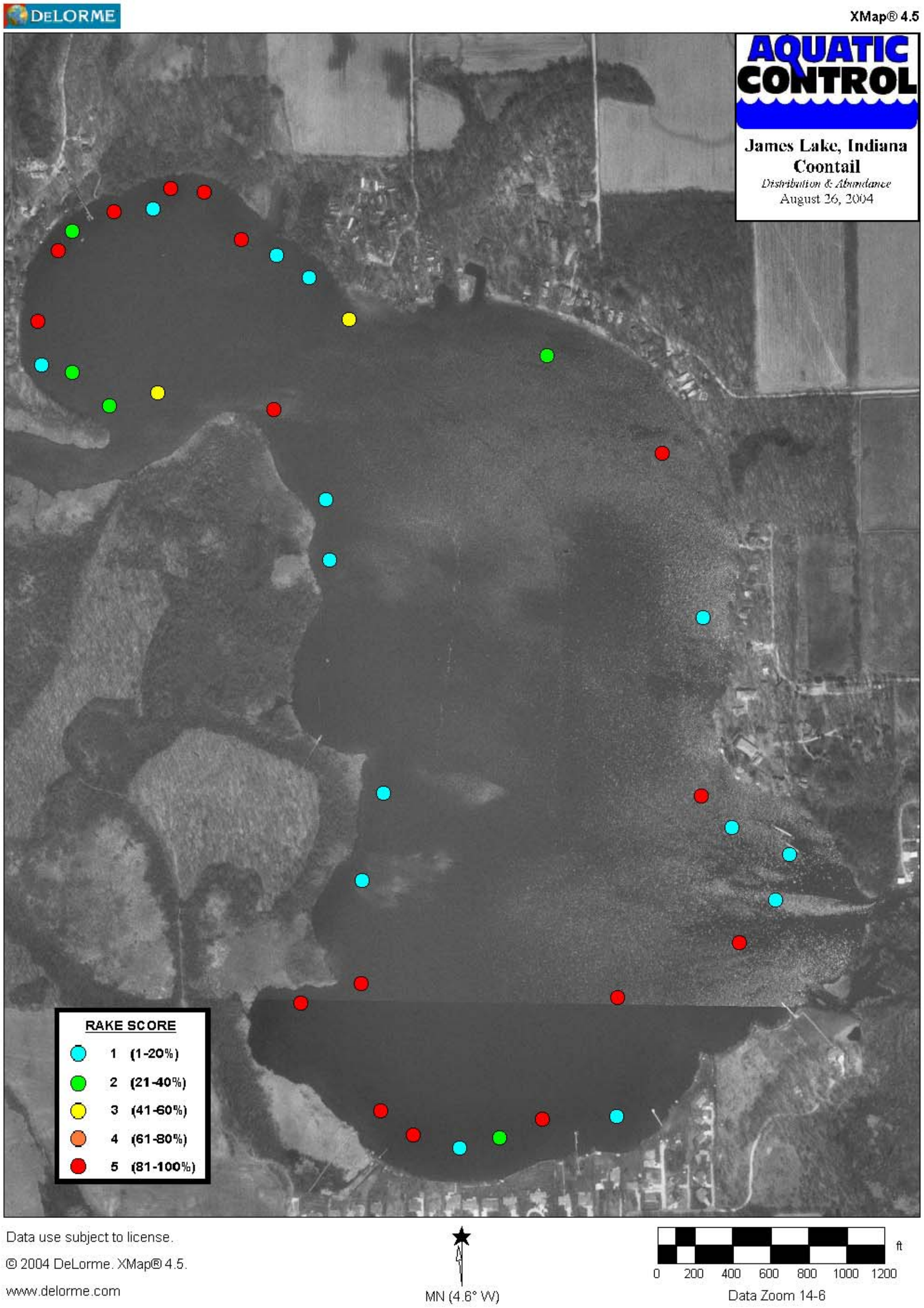
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 200 400 600 800 1000 1200
ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Coontail
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
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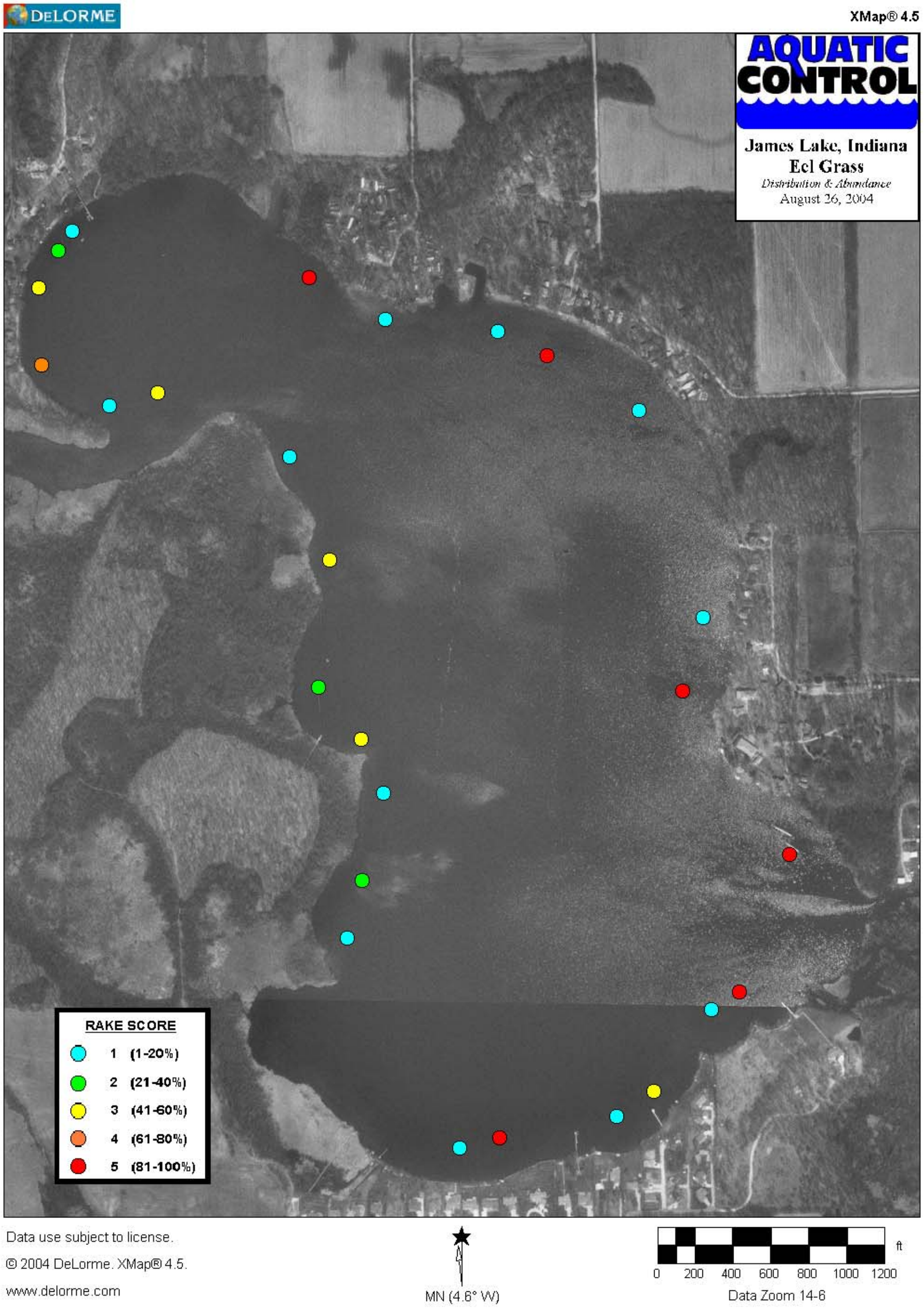
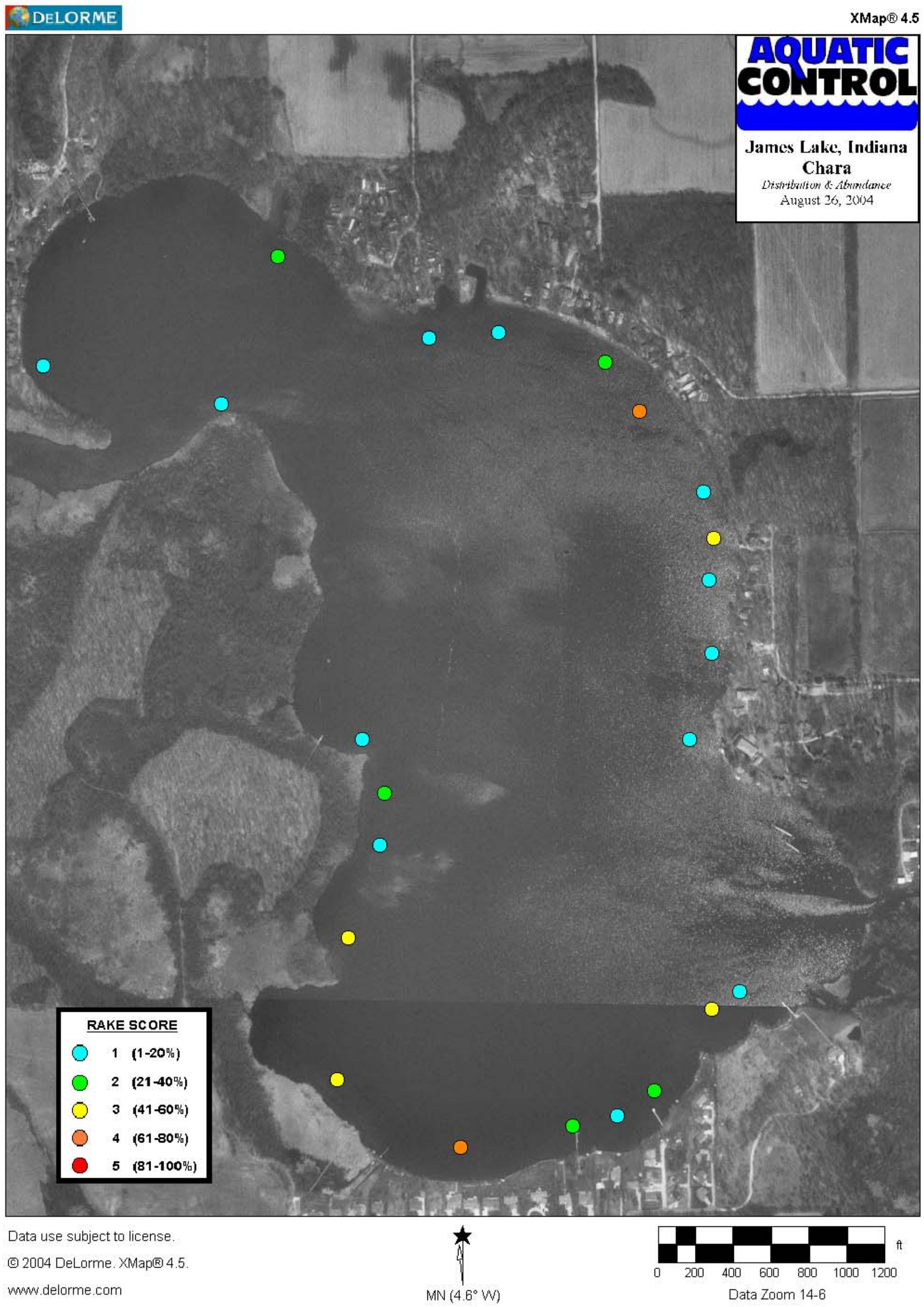
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 200 400 600 800 1000 1200
ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Eel Grass
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 200 400 600 800 1000 1200
ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Chara
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
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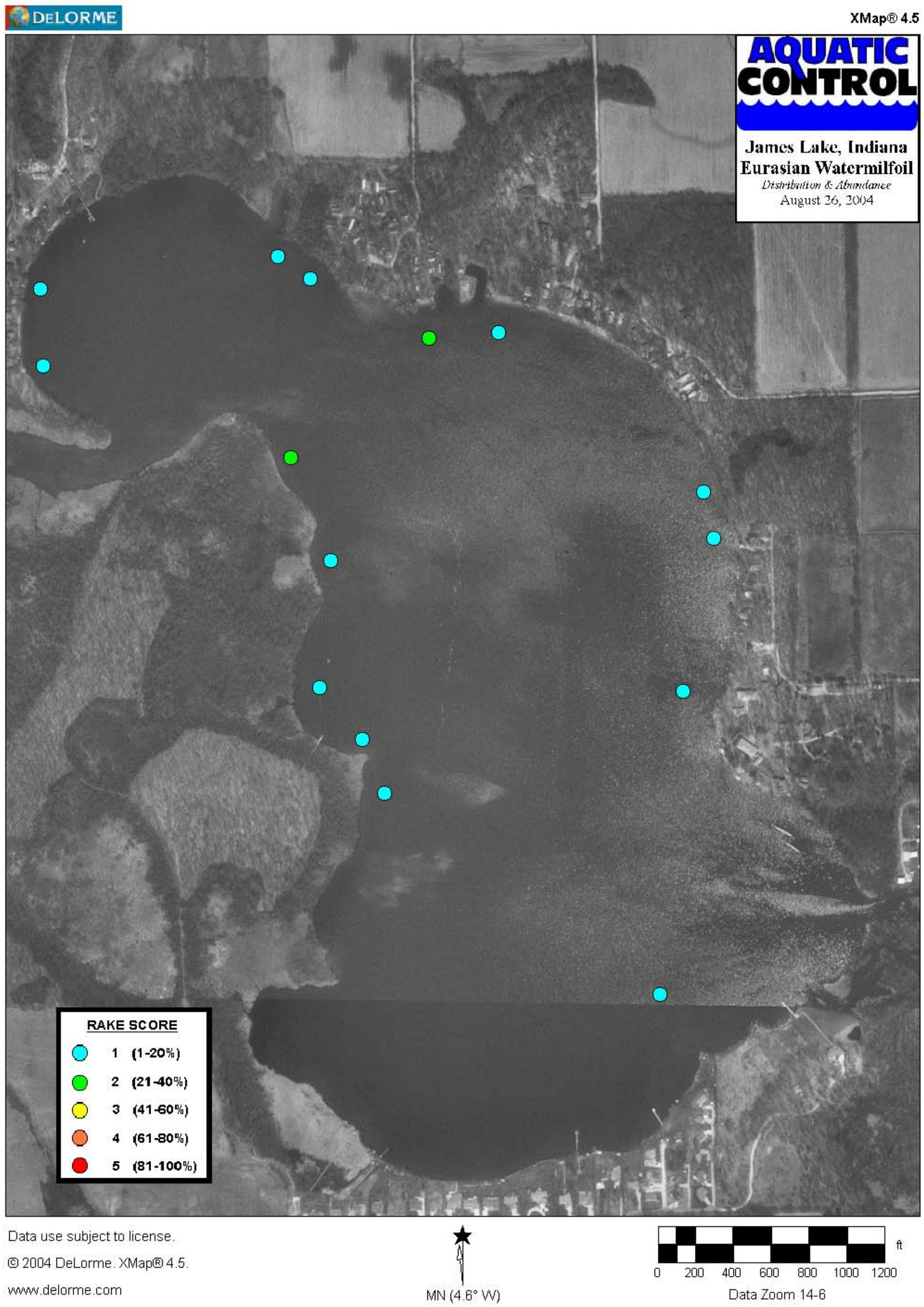
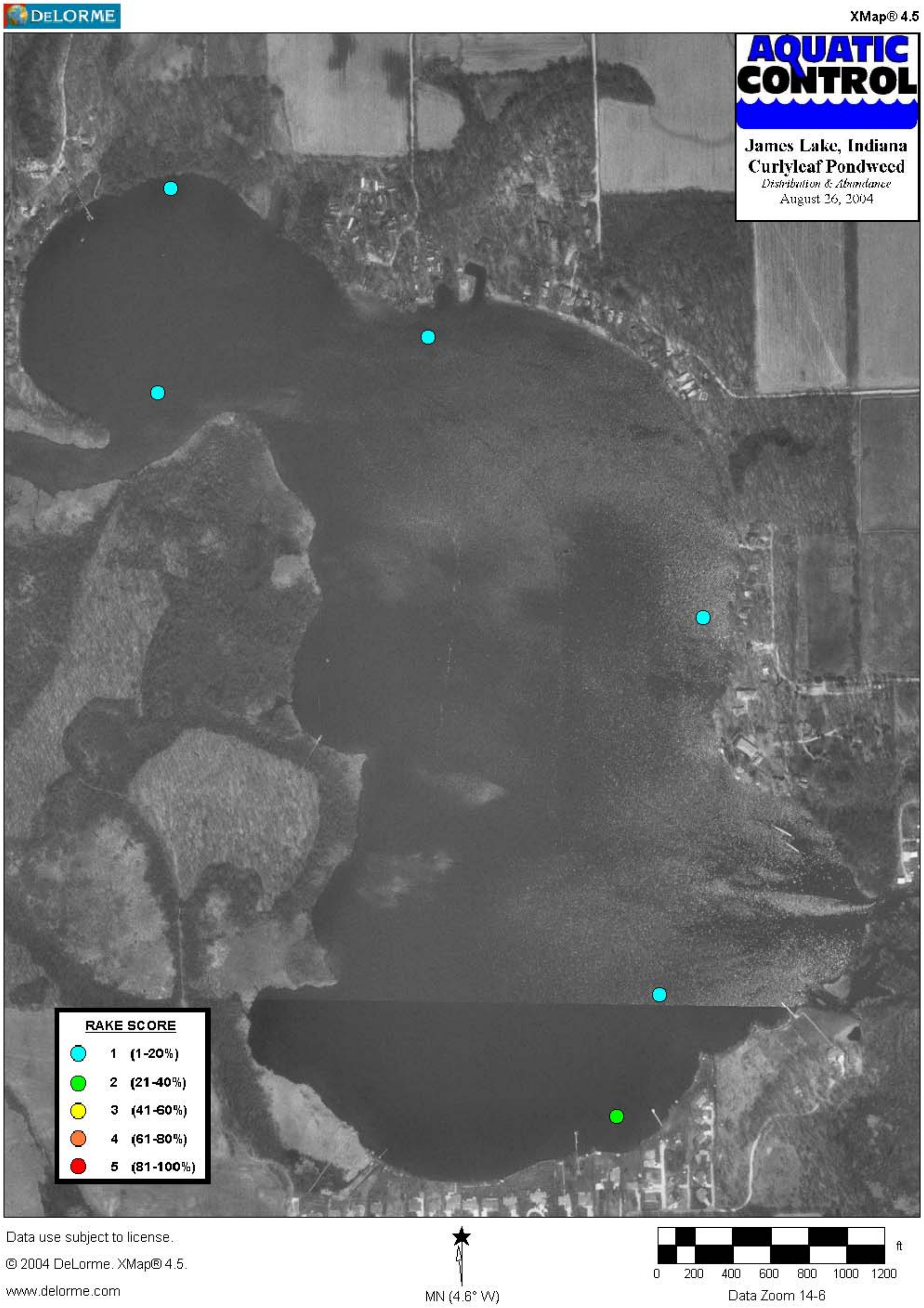
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Eurasian Watermilfoil
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com
MN (4.6° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DELORME
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
Curlyleaf Pondweed
Distribution & Abundance
August 26, 2004
RAKE SCORE
1 (1-20%)
2 (21-40%)
3 (41-60%)
4 (61-80%)
5 (81-100%)
Data use subject to license.
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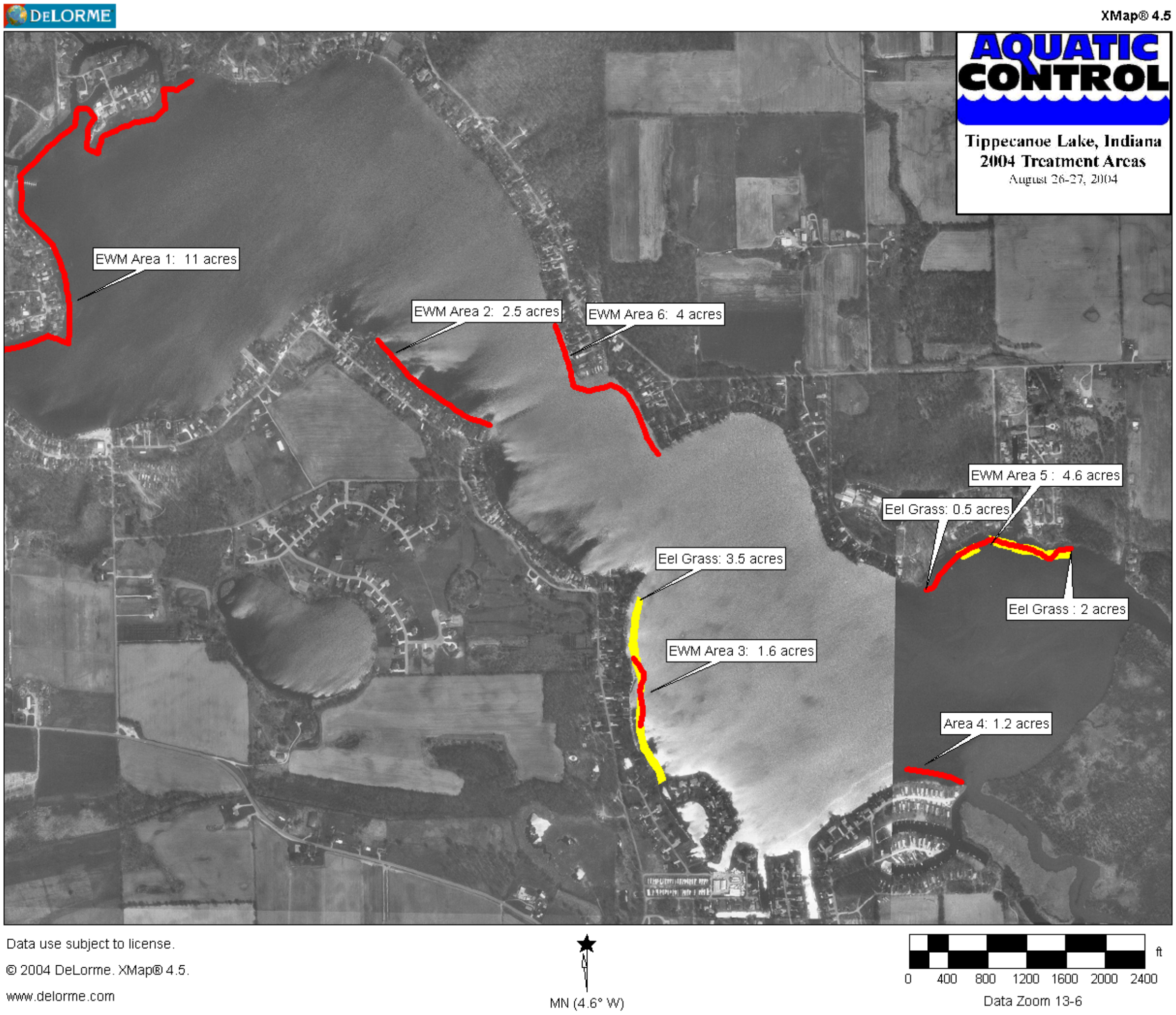
www.delorme.com
MN (4.6° W)
0 200 400 600 800 1000 1200 ft
Data Zoom 14-6


DeLORME
XMap® 4.5
AQUATIC CONTROL
Tippecanoe Lake, Indiana
2004 Treatment Areas
August 26-27, 2004
EWM Area 1: 11 acres
EWM Area 2: 2.5 acres
EWM Area 6: 4 acres
EWM Area 5 : 4.6 acres
Eel Grass: 0.5 acres
Eel Grass: 3.5 acres
Eel Grass : 2 acres
EWM Area 3: 1.6 acres
Area 4: 1.2 acres
Data use subject to license.
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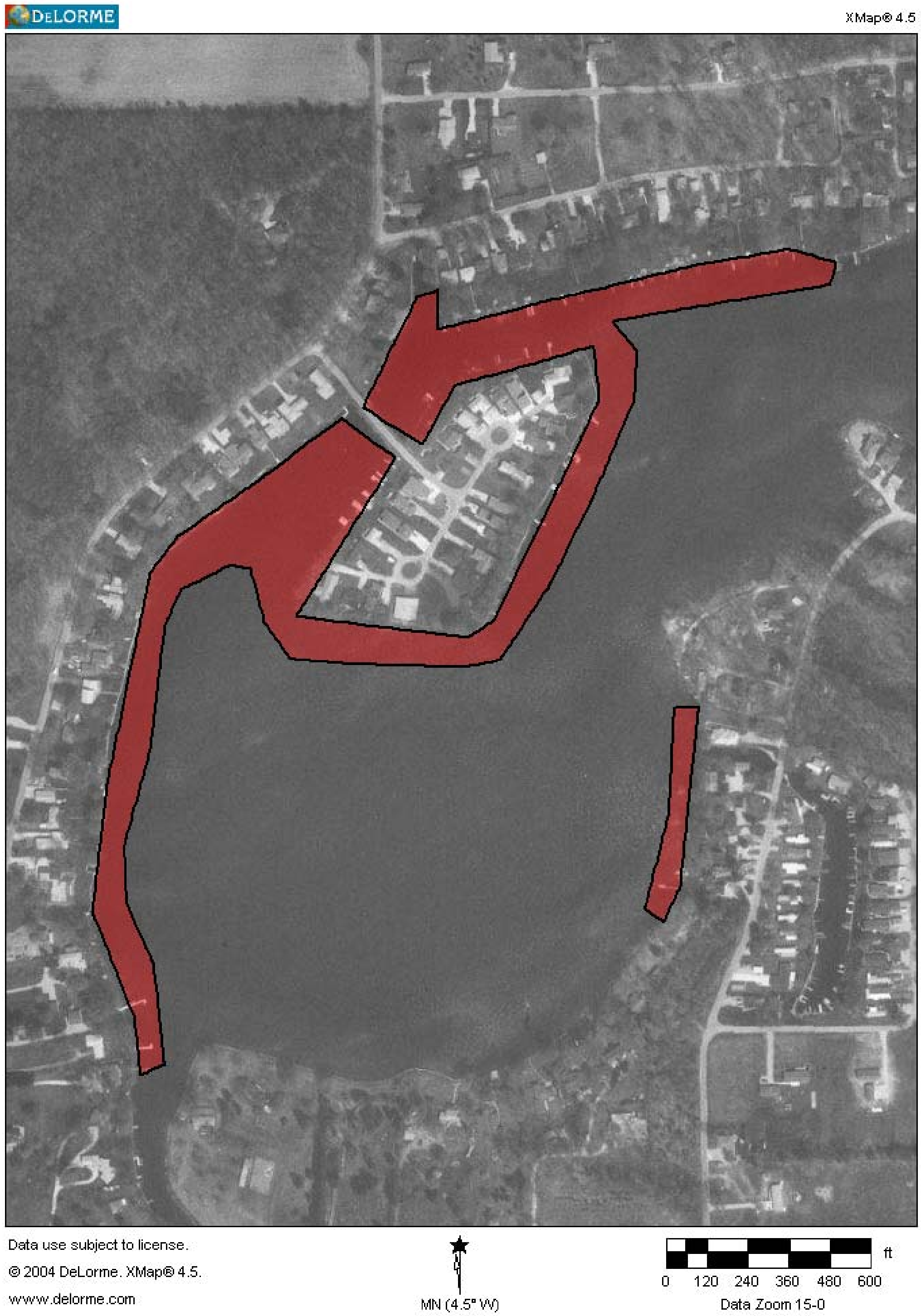
www.delorme.com
MN (4.6° W)
ft
0 400 800 1200 1600 2000 2400
Data Zoom 13-6

Oswego Eurasian watermilfoil and curlyleaf pondweed treament areas.




DeLorme
XMap® 4.5
AQUATIC CONTROL
James Lake, Indiana
2004 Treatment Areas
August 26, 2004
Area 4: 1.5 acres (alternate lots)
Area 5: 0.5 Acres (around pier)
Data use subject to license.
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www.delorme.com
MN (4.5° W)
0 200 400 600 800 1000 1200
ft
Data Zoom 14-6

Appendix C. Tier II Data Sheets

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	VAAM3	POZO	POGR8	ZAPA	ALGA	SpeNum	NatSpeNum	Species Codes	
Oswego Lake	5/24/04	41.32966	-85.78283	161	3.0	3	1			2					1	2	1	BIBE	Bur marigold
Oswego Lake	5/24/04	41.32965	-85.78341	162	6.0	5	2	2	1							3	1	CEDE4	Coontail
Oswego Lake	5/24/04	41.3292	-85.78379	163	5.0	4	4									1	0	CH?AR	Chara
Oswego Lake	5/24/04	41.32877	-85.78401	164	4.0	1	1			1					1	2	1	ELCA7	Elodea
Oswego Lake	5/24/04	41.32768	-85.78465	165	5.0	1			1							1	1	LEMN	Duckweeds
Oswego Lake	5/24/04	41.32713	-85.78508	166	10.0	2		1	1							2	1	MYHE	Broadleaf watermilfoil
Oswego Lake	5/24/04	41.32692	-85.78564	167	10.0	2	1		1							2	1	MYSI	Northern watermilfoil
Oswego Lake	5/24/04	41.32666	-85.78588	168	10.0	5	4	1	1							3	1	MYSP2	Eurasian watermilfoil
Oswego Lake	5/24/04	41.32685	-85.78663	169	5.0	5	3		2						1	2	1	MYVE	Whorled watermilfoil
Oswego Lake	5/24/04	41.32706	-85.78709	170	4.0	3	2	1	1						1	3	1	NAFL	Slender naiad
Oswego Lake	5/24/04	41.32739	-85.78759	171	10.0	5	5		3							2	1	NAGU	Southern waternymph
Oswego Lake	5/24/04	41.32776	-85.78829	172	5.0	5	2	5	2							3	1	NAMA	Spiny naiad
Oswego Lake	5/24/04	41.32738	-85.7887	173	7.0	5	2	5	2							3	1	NAMI	Brittle waternymph
Oswego Lake	5/24/04	41.32683	-85.78891	174	5.0	5	4	5								2	0	NELU	American lotus
Oswego Lake	5/24/04	41.32635	-85.78904	175	5.0	5	2	2	2	1						4	2	NI?TE	Nitella
Oswego Lake	5/24/04	41.32581	-85.78915	176	4.0	1	1		1		1					3	2	NOAQVG	No aquatic vegetation
Oswego Lake	5/24/04	41.32501	-85.78919	177	12.0	2			2							1	1	NULU	Yellow pond lily
Oswego Lake	5/24/04	41.32444	-85.789	178	4.0	2	1		1							2	1	NYTU	White water lily
Oswego Lake	5/24/04	41.32357	-85.78882	179	3.0	1					1					1	1	POAM	Large-leaf pondweed
Oswego Lake	5/24/04	41.3239	-85.78803	180	3.0	3		2		1					1	2	1	POCR3	Curly-leaf pondweed
Oswego Lake	5/24/04	41.32412	-85.78765	181	12.0	1	1		1							2	1	POFO3	Leafy pondweed
Oswego Lake	5/24/04	41.32447	-85.78736	182	24.0	1			1							1	1	POGR8	Variable pondweed
Oswego Lake	5/24/04	41.32387	-85.78655	183	15.0	2			1						1	1	1	POIL	Illinois pondweed
Oswego Lake	5/24/04	41.32387	-85.78559	184	12.0	2										0	0	PONO2	American pondweed
Oswego Lake	5/24/04	41.32419	-85.78476	185	6.0	2				1			1			2	2	POPE6	Sago pondweed
Oswego Lake	5/24/04	41.32458	-85.78457	186	4.0	2				2			1			2	2	POPR5	White-stemmed pondweed
Oswego Lake	5/24/04	41.32478	-85.7841	187	5.0	0									1	0	0	POPU7	Small pondweed
Oswego Lake	5/24/04	41.32509	-85.78374	188	5.0	1					1					1	1	PORI2	Richardson's pondweed
Oswego Lake	5/24/04	41.32563	-85.78383	189	5.0	1							1		1	1	1	POZO	Flat-stemmed pondweed
Oswego Lake	5/24/04	41.32603	-85.78369	190	4.0	1			1		1		1		1	3	3	UTMA	Common bladderwort
Oswego Lake	5/24/04	41.3269	-85.7837	191	3.0	5				5						1	1	VAAM3	Wild celery, eel grass
Oswego Lake	5/24/04	41.32755	-85.78384	192	3.0	1						1			1	1	1	WO?LF	Watermeal
Oswego Lake	5/24/04	41.32824	-85.78334	193	3.0	1	1		1					1	1	3	2	ZAPA	Horned pondweed

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	VAAM3	ELCA7	POZO	POGR8	MYVE	ZODU	ZAPA	UTMA	ALGA	SpeNum	NatSpeNum
Tippecanoe	5/24/04	41.31822	-85.7446	1	3.0	0													1	0	0
Tippecanoe	5/24/04	41.31863	-85.7444	2	3.0	5	1	4					1				1			4	2
Tippecanoe	5/24/04	41.3188	-85.7439	3	3.0	5		4	1				2							3	2
Tippecanoe	5/24/04	41.31894	-85.7433	4	2.0	5	1	5					1							3	1
Tippecanoe	5/24/04	41.31897	-85.7433	5	5.0	5	1	5					1							3	1
Tippecanoe	5/24/04	41.31951	-85.742	6	3.0	4	2	3	1											3	1
Tippecanoe	5/24/04	41.32003	-85.742	7	4.0	4	1	3												2	0
Tippecanoe	5/24/04	41.3206	-85.7422	8	4.0	2	1	1											1	2	0
Tippecanoe	5/24/04	41.3211	-85.7416	9	4.0	2		2												1	0
Tippecanoe	5/24/04	41.32114	-85.7408	10	4.0	5	1	5					1							3	1
Tippecanoe	5/24/04	41.32162	-85.7405	11	4.0	5		5												1	0
Tippecanoe	5/24/04	41.32166	-85.7405	12	3.0	3	1						3							2	1
Tippecanoe	5/24/04	41.32232	-85.7401	13	3.0	3	1	2					1						1	3	1
Tippecanoe	5/24/04	41.32274	-85.7394	14	4.0	1												1	1	1	1
Tippecanoe	5/24/04	41.32259	-85.7387	15	4.0	0				1									1	1	1
Tippecanoe	5/24/04	41.32215	-85.7378	16	4.0	0				1									1	1	1
Tippecanoe	5/24/04	41.32196	-85.7369	17	6.0	0													1	0	0
Tippecanoe	5/24/04	41.3218	-85.736	18	6.0	1				1									1	1	1
Tippecanoe	5/24/04	41.32181	-85.7349	19	10.0	0													1	0	0
Tippecanoe	5/24/04	41.32394	-85.7396	94	5.0	5	3		3										1	2	1
Tippecanoe	5/24/04	41.32417	-85.7402	95	3.0	3	1		2											2	1
Tippecanoe	5/24/04	41.32374	-85.741	96	4.0	3	1	2					1	1						4	2
Tippecanoe	5/24/04	41.32398	-85.7414	97	4.0	1		1	1										1	2	1
Tippecanoe	5/24/04	41.32413	-85.7421	98	4.0	2	1	2					1						1	3	1
Tippecanoe	5/24/04	41.32468	-85.743	99	4.0	3	1	2		1	1								1	4	2
Tippecanoe	5/24/04	41.32485	-85.7438	100	3.0	2		1		1	1		1						1	4	3
Tippecanoe	5/24/04	41.32458	-85.7447	101	4.0	5		4			1								1	2	1
Tippecanoe	5/24/04	41.32419	-85.7454	102	3.0	3		2		1	1								1	3	2
Tippecanoe	5/24/04	41.32405	-85.746	103	4.0	4		4						1						2	1
Tippecanoe	5/24/04	41.32366	-85.7461	104	11.0	3			3											1	1
Tippecanoe	5/24/04	41.32344	-85.747	105	4.0	2		1	1		1		1	1					1	5	4
Tippecanoe	5/24/04	41.32314	-85.7474	106	4.0	2					1			1						2	2
Tippecanoe	5/24/04	41.32351	-85.748	107	4.0	2					1			1					1	2	2
Tippecanoe	5/24/04	41.32371	-85.7487	108	5.0	3		2						1						2	1
Tippecanoe	5/24/04	41.32365	-85.7497	109	4.0	1					1									1	1
Tippecanoe	5/24/04	41.3241	-85.75	110	3.0	1							1						1	1	1
Tippecanoe	5/24/04	41.32415	-85.7512	111	5.0	3		3					1							2	1
Tippecanoe	5/24/04	41.32406	-85.7515	112	5.0	1		1						1						2	1
Tippecanoe	5/24/04	41.3241	-85.7514	113	17.0	2			2											1	1
Tippecanoe	5/24/04	41.32482	-85.7512	114	5.0	1							1							1	1
Tippecanoe	5/24/04	41.32551	-85.7515	115	5.0	2							2							1	1
Tippecanoe	5/24/04	41.32638	-85.7518	116	4.0	1							1						1	1	1
Tippecanoe	5/24/04	41.32741	-85.752	117	4.0	2				2			1							2	2
Tippecanoe	5/24/04	41.32727	-85.7528	118	6.0	5		5												1	0
Tippecanoe	5/24/04	41.32746	-85.7536	119	12.0	3		2	1		1									3	2
Tippecanoe	5/24/04	41.32754	-85.755	120	4.0	4														0	0
Tippecanoe	5/24/04	41.32695	-85.7562	121	5.0	2		1						1					1	2	1
Tippecanoe	5/24/04	41.32757	-85.7572	122	4.0	1								1					1	1	1
Tippecanoe	5/24/04	41.32845	-85.758	123	5.0	2		2												1	0
Tippecanoe	5/24/04	41.32876	-85.7589	124	12.0	2			2		2									2	2
Tippecanoe	5/24/04	41.32937	-85.7598	125	2.0	0													1	0	0
Tippecanoe	5/24/04	41.32949	-85.7603	126	5.0	5		4								1				2	1
Tippecanoe	5/24/04	41.33028	-85.7607	127	5.0	2		2												1	0
Tippecanoe	5/24/04	41.33139	-85.7611	128	18.0	0														0	0
Tippecanoe	5/24/04	41.33298	-85.7615	129	12.0	1		1												1	0
Tippecanoe	5/24/04	41.33344	-85.7619	130	8.0	1		1	1		1		1						1	4	3
Tippecanoe	5/24/04	41.33436	-85.7627	131	15.0	1		1					1							2	1
Tippecanoe	5/24/04	41.33539	-85.7638	132	3.0	0													1	0	0
Tippecanoe	5/24/04	41.33648	-85.7652	133	10.0	2		1	1		2		1							4	3
Tippecanoe	5/24/04	41.33642	-85.7657	134	20.0	0														0	0
Tippecanoe	5/24/04	41.33773	-85.7669	135	8.0	1		1												1	0
Tippecanoe	5/24/04	41.33786	-85.7675	136	6.0	2		2					1						1	2	1
Tippecanoe	5/24/04	41.33787	-85.7685	137	4.0	1				1									1	1	1
Tippecanoe	5/24/04	41.33771	-85.7694	138	3.0	0													1	0	0
Tippecanoe	5/24/04	41.33706	-85.7706	139	4.0	0													1	0	0
Tippecanoe	5/24/04	41.33719	-85.7721	140	3.0	3		1					3							2	1
Tippecanoe	5/24/04	41.33719	-85.7731	141	3.0	1				1			1						1	2	2
Tippecanoe	5/24/04	41.33736	-85.7744	142	3.0	1				1				1					1	2	2
Tippecanoe	5/24/04	41.33637	-85.7758	143	3.0	1							1	1					1	2	2
Tippecanoe	5/24/04	41.3362	-85.7763	144	4.0	1				1									1	1	1
Tippecanoe	5/24/04	41.33607	-85.7779	145	2.0	5	1			5										2	1
Tippecanoe	5/24/04	41.33627	-85.7784	146	3.0	5				5										1	1
Tippecanoe	5/24/04	41.33579	-85.7791	147	3.0	2				2										1	1

Species Codes	
BIBE	Bur marigold
CEDE4	Coontail
CH?AR	Chara
ELCA7	Elodea
LEMN	Duckweeds
MYHE	Broadleaf watermilfoil
MYSI	Northern watermilfoil
MYSP2	Eurasian watermilfoil
MYVE	Whorled watermilfoil
NAFL	Slender naiad
NAGU	Southern waternymph
NAMA	Spiny naiad
NAMI	Brittle waternymph
NELU	American lotus
NI?TE	Nitella
NOAQVG	No aquatic vegetation
NULU	Yellow pond lily
NYTU	White water lily
POAM	Large-leaf pondweed
POCR3	Curly-leaf pondweed
POFO3	Leafy pondweed
POGR8	Variable pondweed
POIL	Illinois pondweed
PONO2	American pondweed
POPE6	Sago pondweed
POPR5	White-stemmed pondweed
POPU7	Small pondweed
PORI2	Richardson's pondweed
POZO	Flat-stemmed pondweed
UTMA	Common bladderwort
VAAM3	Wild celery, eel grass
WO?LF	Watermeal
ZAPA	Horned pondweed
ZODU	Water stargrass
Count	34

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	VAAM3	ELCA7	POZO	POGR8	MYVE	ZODU	ZAPA	UTMA	ALGA	SpeNum	NatSpeNum
Tippecanoe	5/24/04	41.33526	-85.7793	148	3.0	2				1	1			1						3	3
Tippecanoe	5/24/04	41.33361	-85.7791	149	6.0	2				2									1	1	1
Tippecanoe	5/24/04	41.33309	-85.7786	150	4.0	3				3									1	1	1
Tippecanoe	5/24/04	41.33229	-85.7784	151	5.0	1	1			1									1	2	1
Tippecanoe	5/24/04	41.33157	-85.7782	152	4.0	3				3									1	1	1
Tippecanoe	5/24/04	41.33106	-85.7778	153	8.0	1	1	1											1	2	0
Tippecanoe	5/24/04	41.33055	-85.7783	154	9.0															0	0
Tippecanoe	5/24/04	41.33033	-85.7791	155	3.0	1		1											1	1	0
Tippecanoe	5/24/04	41.33034	-85.7797	156	3.0	3				3									1	1	1
Tippecanoe	5/24/04	41.33014	-85.7802	157	5.0	1	1			1	1								1	3	2
Tippecanoe	5/24/04	41.32991	-85.7806	158	4.0	5				4					1				1	2	2
Tippecanoe	5/24/04	41.32975	-85.7811	159	3.0	5	1			4										2	1
Tippecanoe	5/24/04	41.32961	-85.7819	160	4.0	5	1	1		4							1		1	4	2
Tippecanoe	5/24/04	41.32869	-85.7824	194	3.0	1				1				1						2	2
Tippecanoe	5/24/04	41.32909	-85.7815	195	3.0	4				4										1	1
Tippecanoe	5/24/04	41.32873	-85.7803	196	4.0	3				3									1	1	1
Tippecanoe	5/24/04	41.32845	-85.7794	197	5.0	4	2	3											1	2	0
Tippecanoe	5/24/04	41.32811	-85.7786	198	5.0	4	2			2									1	2	1
Tippecanoe	5/24/04	41.32823	-85.7776	199	11.0	5		4	2											2	1
Tippecanoe	5/24/04	41.32837	-85.7766	200	5.0	4	1	3						1						3	1
Tippecanoe	5/24/04	41.32845	-85.7758	201	5.0	4	2	2	1										1	3	1
Tippecanoe	5/24/04	41.32866	-85.7754	202	9.0	5		2	2					1						3	2
Tippecanoe	5/24/04	41.32871	-85.7751	203	6.0	3	1	2						1					1	3	1
Tippecanoe	5/24/04	41.32863	-85.7742	204	4.0	3				3										1	1
Tippecanoe	5/24/04	41.32897	-85.7733	205	4.0	2				2									1	1	1
Tippecanoe	5/24/04	41.32966	-85.7731	206	4.0	1				1									1	1	1
Tippecanoe	5/24/04	41.33051	-85.773	207	5.0	1				1				1					1	2	2
Tippecanoe	5/24/04	41.3311	-85.773	208	30.0	0														0	0
Tippecanoe	5/24/04	41.33081	-85.7715	209	5.0	2	2												1	1	0
Tippecanoe	5/24/04	41.33104	-85.7707	210	4.0	2	1			1		1							1	3	2
Tippecanoe	5/24/04	41.33163	-85.7695	211	30.0	0														0	0
Tippecanoe	5/24/04	41.33118	-85.7686	212	4.0	1							1						1	1	1
Tippecanoe	5/24/04	41.33038	-85.7672	213	11.0	1		1												1	0
Tippecanoe	5/24/04	41.32977	-85.7664	214	24.0	0														0	0
Tippecanoe	5/24/04	41.32897	-85.7649	215	6.0	2		1			1			1					1	3	2
Tippecanoe	5/24/04	41.32826	-85.7633	216	13.0	1		1												1	0
Tippecanoe	5/24/04	41.32799	-85.7627	217	5.0	2	1	1	1										1	3	1
Tippecanoe	5/24/04	41.32751	-85.7625	218	15.0	2		1	2		1									3	2
Tippecanoe	5/24/04	41.32689	-85.7627	219	3.0	3	1	2		1									1	3	1
Tippecanoe	5/24/04	41.32668	-85.7624	220	4.0	4		3		1									1	2	1
Tippecanoe	5/24/04	41.32676	-85.7621	221	3.0	1		1			1			1						3	2
Tippecanoe	5/24/04	41.32647	-85.7623	222	5.0	5		5						1						2	1
Tippecanoe	5/24/04	41.32577	-85.7618	223	5.0	2		2											1	1	0
Tippecanoe	5/24/04	41.32546	-85.761	224	5.0	2		1						1						2	1
Tippecanoe	5/24/04	41.32501	-85.7604	225	4.0	0														0	0
Tippecanoe	5/24/04	41.32444	-85.7595	226	4.0	1													1	0	0
Tippecanoe	5/24/04	41.32416	-85.7582	227	4.0	1		1		1									1	2	1
Tippecanoe	5/24/04	41.32423	-85.7573	228	4.0	1		1			1			1						3	2
Tippecanoe	5/24/04	41.32352	-85.7569	229	6.0	1								1					1	1	1
Tippecanoe	5/24/04	41.3228	-85.7569	230	8.0	4	2	2												2	0
Tippecanoe	5/24/04	41.3216	-85.7572	231	8.0	5		5												1	0
Tippecanoe	5/24/04	41.32068	-85.7571	232	4.0	1		1		1										2	1
Tippecanoe	5/24/04	41.32041	-85.7568	233	6.0	4		4												1	0
Tippecanoe	5/24/04	41.31974	-85.7566	234	11.0	3	3		1											2	1
Tippecanoe	5/24/04	41.31857	-85.7553	235	3.0	1				1										1	1
Tippecanoe	5/24/04	41.31821	-85.754	236	3.0	1				1										1	1
Tippecanoe	5/24/04	41.31778	-85.7533	237	7.0	0														0	0
Tippecanoe	5/24/04	41.31643	-85.7519	238	3.0	1				1									1	1	1
Tippecanoe	5/24/04	41.31752	-85.75	239	3.0	1				1			1						1	2	2
Tippecanoe	5/24/04	41.31803	-85.7487	240	3.0	5				5			1						1	2	2
Tippecanoe	5/24/04	41.31835	-85.7476	241	3.0	3				3										1	1
Tippecanoe	5/24/04	41.31866	-85.7469	242	3.0	4		4	4										1	2	1
Tippecanoe	5/24/04	41.31911	-85.7465	243	3.0	5	2	4												2	0
Tippecanoe	5/24/04	41.31949	-85.7464	244	3.0	5														0	0
Tippecanoe	5/24/04	41.31976	-85.7462	245	22.0	0														0	0
Tippecanoe	5/24/04	41.31946	-85.7458	246	10.0	0													1	0	0
Tippecanoe	5/24/04	41.31897	-85.7456	247	4.0	0													1	0	0

Species Codes	
BIBE	Bur marigold
CEDE4	Coontail
CH?AR	Chara
ELCA7	Elodea
LEMN	Duckweeds
MYHE	Broadleaf watermilfoil
MYSI	Northern watermilfoil
MYSP2	Eurasian watermilfoil
MYVE	Whorled watermilfoil
NAFL	Slender naiad
NAGU	Southern waternymph
NAMA	Spiny naiad
NAMI	Brittle waternymph
NELU	American lotus
NI?TE	Nitella
NOAQVG	No aquatic vegetation
NULU	Yellow pond lily
NYTU	White water lily
POAM	Large-leaf pondweed
POCR3	Curly-leaf pondweed
POFO3	Leafy pondweed
POGR8	Variable pondweed
POIL	Illinois pondweed
PONO2	American pondweed
POPE6	Sago pondweed
POPR5	White-stemmed pondweed
POPU7	Small pondweed
PORI2	Richardson's pondweed
POZO	Flat-stemmed pondweed
UTMA	Common bladderwort
VAAM3	Wild celery, eel grass
WO?LF	Watermeal
ZAPA	Horned pondweed
ZODU	Water stargrass
Count	34

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	VAAM3	ELCA7	POZO	POAM	POGR8	ZAPA	BIBE	ALGA	SpeNum	NatSpeNum
James Lake	5/24/04	41.32241	-85.7331	20	6.0	5		3	3										2	1
James Lake	5/24/04	41.32281	-85.7326	21	3.0	0												1	0	0
James Lake	5/24/04	41.32266	-85.7318	22	3.0	2		1	1										2	1
James Lake	5/24/04	41.32217	-85.7312	23	3.0	5		5											1	0
James Lake	5/24/04	41.32187	-85.7308	24	3.0	5	1	3		5								1	3	1
James Lake	5/24/04	41.32139	-85.7306	25	3.0	3			1	2			1					1	3	3
James Lake	5/24/04	41.3209	-85.7304	26	3.0	4				3								1	1	1
James Lake	5/24/04	41.32055	-85.7302	27	4.0	5		2	4										2	1
James Lake	5/24/04	41.32004	-85.7302	28	3.0	5				5									1	1
James Lake	5/24/04	41.31966	-85.7302	29	4.0	5		2	5	3									3	2
James Lake	5/24/04	41.31924	-85.7306	30	4.0	2							2					1	1	1
James Lake	5/24/04	41.31884	-85.7307	31	3.0	3				3								1	1	1
James Lake	5/24/04	41.31827	-85.7305	32	7.0	5			5										1	1
James Lake	5/24/04	41.31793	-85.7302	33	5.0	3	2	1											2	0
James Lake	5/24/04	41.31778	-85.7295	34	3.0	1			1									1	1	1
James Lake	5/24/04	41.31719	-85.7295	35	2.0	2			1	1									2	2
James Lake	5/24/04	41.31686	-85.7293	36	3.0	3			3				1					1	2	2
James Lake	5/24/04	41.31653	-85.7295	37	4.0	5		5								1		1	2	1
James Lake	5/24/04	41.31609	-85.7298	38	3.0	4				4								1	1	1
James Lake	5/24/04	41.31572	-85.7297	39	4.0	4			1	3								1	2	2
James Lake	5/24/04	41.31524	-85.7303	40	4.0	3	1		2				1					1	3	2
James Lake	5/24/04	41.31481	-85.73	41	4.0	3	2	1											2	0
James Lake	5/24/04	41.3143	-85.73	42	4.0	4		2	1	1								1	3	2
James Lake	5/24/04	41.31409	-85.7305	43	6.0	4		2	2										2	1
James Lake	5/24/04	41.31398	-85.7314	44	10.0	5		3	3										2	1
James Lake	5/24/04	41.31365	-85.7315	45	4.0	1		1					1					1	2	1
James Lake	5/24/04	41.31319	-85.7312	46	3.0	1				1			1					1	2	2
James Lake	5/24/04	41.31308	-85.7307	47	2.0	3				1								1	1	1
James Lake	5/24/04	41.3126	-85.7296	48	19.0	0													0	0
James Lake	5/24/04	41.31207	-85.7292	49	5.0	3		2	1										2	1
James Lake	5/24/04	41.31185	-85.7286	50	6.0	2		2										1	1	0
James Lake	5/24/04	41.31162	-85.7281	51	3.0	2		2					1						2	1
James Lake	5/24/04	41.31193	-85.7274	52	4.0	2		1	1				1					1	3	2
James Lake	5/24/04	41.31205	-85.7267	53	4.0	3		2		1			1					1	3	2
James Lake	5/24/04	41.31211	-85.7253	54	3.0	3		3		1								1	2	1
James Lake	5/24/04	41.31265	-85.7251	55	24.0	0													0	0
James Lake	5/24/04	41.31265	-85.7247	56	5.0	3			3									1	1	1
James Lake	5/24/04	41.31293	-85.7238	57	2.0	1				1								1	1	1
James Lake	5/24/04	41.31361	-85.7233	58	3.0	1				1			1					1	2	2
James Lake	5/24/04	41.31365	-85.7226	59	2.0	1				1								1	1	1
James Lake	5/24/04	41.31443	-85.7222	60	5.0	3			2	1	1							1	3	3
James Lake	5/24/04	41.31548	-85.7215	61	3.0	2		2	1									1	2	1
James Lake	5/24/04	41.31636	-85.7215	62	5.0	1		1	1									1	2	1
James Lake	5/24/04	41.31663	-85.7226	63	7.0	5			5										1	1
James Lake	5/24/04	41.31669	-85.7236	64	30.0	0													0	0
James Lake	5/24/04	41.3179	-85.7234	65	4.0	2				2			1					1	2	2
James Lake	5/24/04	41.31865	-85.7234	66	3.0	2				1			1		1			1	3	3
James Lake	5/24/04	41.31929	-85.7229	67	3.0	0												1	0	0
James Lake	5/24/04	41.31974	-85.7231	68	3.0	1				1								1	1	1
James Lake	5/24/04	41.32065	-85.7231	69	6.0	5		2	5										2	1
James Lake	5/24/04	41.32138	-85.7231	70	6.0	1		1					1						2	1
James Lake	5/24/04	41.32207	-85.7235	71	3.0	0												1	0	0
James Lake	5/24/04	41.32251	-85.724	72	3.0	1				1								1	1	1
James Lake	5/24/04	41.32292	-85.7246	73	4.0	1	1												1	0
James Lake	5/24/04	41.32275	-85.7251	74	5.0	1				1								1	1	1
James Lake	5/24/04	41.32359	-85.7258	75	5.0	5	2	4											2	0
James Lake	5/24/04	41.32379	-85.7268	76	3.0	5	2	3		3									3	1
James Lake	5/24/04	41.3239	-85.7279	77	3.0	2	1			2						1			3	2
James Lake	5/24/04	41.32387	-85.7288	78	4.0	5	2	4	1	1						1			5	3
James Lake	5/24/04	41.3237	-85.7296	79	11.0	1			1										1	1
James Lake	5/24/04	41.32423	-85.7302	80	6.0	2		2	1										2	1
James Lake	5/24/04	41.32449	-85.7308	81	4.0	5		4	1					1					3	2
James Lake	5/24/04	41.32498	-85.7315	82	3.0	3		2	1	1								1	3	2
James Lake	5/24/04	41.32541	-85.7324	83	15.0	1			1										1	1
James Lake	5/24/04	41.32542	-85.7324	84	18.0	0													0	0
James Lake	5/24/04	41.32542	-85.7333	85	10.0	0													0	0
James Lake	5/24/04	41.32572	-85.7335	86	3.0	5		5	3			3					1		3	2
James Lake	5/24/04	41.32549	-85.7342	87	25.0	0													0	0
James Lake	5/24/04	41.32507	-85.7351	88	20.0	0													0	0
James Lake	5/24/04	41.32465	-85.7354	89	17.0	0													0	0
James Lake	5/24/04	41.32426	-85.7358	90	10.0	3			3										1	1
James Lake	5/24/04	41.32369	-85.7359	91	15.0	0													0	0
James Lake	5/24/04	41.32312	-85.7356	92	6.0	3		1	2				1						3	2
James Lake	5/24/04	41.32278	-85.7349	93	5.0	2		1	1						1				3	2

Species Codes	
BIBE	Bur marigold
CEDE4	Coontail
CH?AR	Chara
ELCA7	Elodea
LEMN	Duckweeds
MYHE	Broadleaf watermilfoil
MYSI	Northern watermilfoil
MYSP2	Eurasian watermilfoil
MYVE	Whorled watermilfoil
NAFL	Slender naiad
NAGU	Southern waternymph
NAMA	Spiny naiad
NAMI	Brittle waternymph
NELU	American lotus
NI?TE	Nitella
NOAQVG	No aquatic vegetation
NULU	Yellow pond lily
NYTU	White water lily
POAM	Large-leaf pondweed
POCR3	Curly-leaf pondweed
POFO3	Leafy pondweed
POGR8	Variable pondweed
POIL	Illinois pondweed
PONO2	American pondweed
POPE6	Sago pondweed
POPR5	White-stemmed pondweed
POPU7	Small pondweed
PORI2	Richardson's pondweed
POZO	Flat-stemmed pondweed
UTMA	Common bladderwort
VAAM3	Wild celery, eel grass
WO?LF	Watermeal
ZAPA	Horned pondweed
ZODU	Water stargrass
Count	34

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	NAFL	POPE6	VAAM3	ELCA7	POZO	PORI2	NAMA	POIL	ALGA	SpeNum	NatSpeNum		Species Codes	
Oswego	8/25/04	41.32948	-85.7845	1	6.0	4			2	2										2	2		BIBE	Bur marigold
Oswego	8/25/04	41.32934	-85.7856	2	7.0	4		1	2		2			1						4	3		CEDE4	Coontail
Oswego	8/25/04	41.3291	-85.7839	3	5.0	1			1											1	1		CH?AR	Chara
Oswego	8/25/04	41.32845	-85.784	4	6.0	5	1					2	4							3	2		ELCA7	Elodea
Oswego	8/25/04	41.32786	-85.7846	5	7.0	5	1	1	2							2				4	2		LEMN	Duckweeds
Oswego	8/25/04	41.32716	-85.7851	6	8.0	5	1		5											2	1		MYHE	Broadleaf watermilfoil
Oswego	8/25/04	41.32646	-85.7853	7	13.0	5			5											1	1		MYSI	Northern watermilfoil
Oswego	8/25/04	41.32617	-85.7864	8	17.0	1			1											1	1		MYSP2	Eurasian watermilfoil
Oswego	8/25/04	41.32686	-85.7867	9	4.0	1				1									1	1	1		MYVE	Whorled watermilfoil
Oswego	8/25/04	41.32748	-85.7876	10	8.0	5			5											1	1		NAFL	Slender naiad
Oswego	8/25/04	41.32822	-85.787	11	7.0	4		1	4											2	1		NAGU	Southern waternymph
Oswego	8/25/04	41.32755	-85.7884	12	6.0	4			4				1							2	2		NAMA	Spiny naiad
Oswego	8/25/04	41.32682	-85.7887	13	5.0	2			2	1										2	2		NAMI	Brittle waternymph
Oswego	8/25/04	41.32658	-85.7882	14	7.0	1			1										1	1	1		NELU	American lotus
Oswego	8/25/04	41.32646	-85.7872	15	8.0	3					1	1	3							3	3		NI?TE	Nitella
Oswego	8/25/04	41.32631	-85.7847	16	5.0	5							4			1			1	2	2		NOAQVG	No aquatic vegetation
Oswego	8/25/04	41.32635	-85.7839	17	4.0	3							3							1	1		NULU	Yellow pond lily
Oswego	8/25/04	41.32601	-85.7835	18	4.0	5				3			3							2	2		NYTU	White water lily
Oswego	8/25/04	41.32608	-85.787	19	15.0	3			3										1	1	1		POAM	Large-leaf pondweed
Oswego	8/25/04	41.32625	-85.7885	20	6.0	3							3							1	1		POCR3	Curly-leaf pondweed
Oswego	8/25/04	41.32588	-85.789	21	4.0	5						1	5							2	2		POFO3	Leafy pondweed
Oswego	8/25/04	41.32559	-85.7884	22	18.0	0														0	0		POGR8	Variable pondweed
Oswego	8/25/04	41.32505	-85.7888	23	14.0	2			2											1	1		POIL	Illinois pondweed
Oswego	8/25/04	41.32441	-85.789	24	4.0	1				1			1							2	2		PONO2	American pondweed
Oswego	8/25/04	41.32396	-85.7888	25	5.0	5				5			1					1		3	3		POPE6	Sago pondweed
Oswego	8/25/04	41.32324	-85.7889	26	4.0	5				1	1		5							3	3		POPR5	White-stemmed pondweed
Oswego	8/25/04	41.32415	-85.7882	27	13.0	5			5											1	1		POPU7	Small pondweed
Oswego	8/25/04	41.32389	-85.7875	28	4.0	3				3										1	1		PORI2	Richardson's pondweed
Oswego	8/25/04	41.32398	-85.7869	29	17.0	2			2											1	1		POZO	Flat-stemmed pondweed
Oswego	8/25/04	41.3237	-85.7865	30	3.0	2				2										1	1		UTMA	Common bladderwort
Oswego	8/25/04	41.3239	-85.7856	31	14.0	5			5											1	1		VAAM3	Wild celery, eel grass
Oswego	8/25/04	41.32386	-85.7851	32	4.0	5	1		1	5		1	2							5	4		WO?LF	Watermeal
Oswego	8/25/04	41.32434	-85.7846	33	6.0	3				1							1			2	2		ZAPA	Horned pondweed
Oswego	8/25/04	41.32495	-85.7843	34	16.0	1			1											1	1		ZODU	Water stargrass
Oswego	8/25/04	41.32543	-85.7837	35	5.0	3							2		1		1			3	3			
Oswego	8/25/04	41.32688	-85.7836	36	3.0	5				5										1	1		Count	34
Oswego	8/25/04	41.32765	-85.7837	37	3.0	3			1	2		1	1							4	4			
Oswego	8/25/04	41.3283	-85.7832	38	3.0	3				1		1	3		1			1		5	5			
Oswego	8/25/04	41.32882	-85.7832	39	4.0	5						5								1	1			
Oswego	8/25/04	41.3289	-85.7828	40	4.0	0													1	0	0			

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	NAFL	POPE6	POPU7	VAAM3	POZO	PORI2	POGR8	ZODU	POIL	ALGA	SpeNum	NatSpeNum
Tippecano	8/25/04	41.32815	-85.7773	41	8.0	3	1							2		1					3	2
Tippecano	8/25/04	41.32834	-85.7762	42	5.0	5				3	1	1		5							4	4
Tippecano	8/25/04	41.32872	-85.7748	43	8.0	2								2							1	1
Tippecano	8/25/04	41.32909	-85.7732	44	4.0	1									1						1	1
Tippecano	8/25/04	41.33021	-85.773	45	6.0	2	1								1						2	1
Tippecano	8/25/04	41.33108	-85.7709	46	13.0	3			2					1							2	2
Tippecano	8/25/04	41.33143	-85.7699	47	5.0	5	5		1												2	1
Tippecano	8/25/04	41.33159	-85.7685	48	18.0	2			2												1	1
Tippecano	8/25/04	41.33067	-85.7677	49	4.0	1				1	1			1		1					4	4
Tippecano	8/25/04	41.3302	-85.7669	50	6.0	3	1		1					2							3	2
Tippecano	8/25/04	41.32972	-85.7662	51	13.0	1			1												1	1
Tippecano	8/25/04	41.32912	-85.7653	52	5.0	5				1		1		5							3	3
Tippecano	8/25/04	41.32879	-85.7643	53	16.0	2			2												1	1
Tippecano	8/25/04	41.32836	-85.763	54	15.0	0															0	0
Tippecano	8/25/04	41.32776	-85.7627	55	4.0	5								5							1	1
Tippecano	8/25/04	41.32702	-85.7626	56	4.0	1									1						1	1
Tippecano	8/25/04	41.32624	-85.7623	57	4.0	4				1		1		3							3	3
Tippecano	8/25/04	41.32603	-85.7618	58	12.0	1			1					1							2	2
Tippecano	8/25/04	41.32555	-85.7615	59	4.0	4	1		1	1				3			1				5	4
Tippecano	8/25/04	41.32518	-85.761	60	4.0	3				1				3							2	2
Tippecano	8/25/04	41.32512	-85.7605	61	13.0	3			3					1							2	2
Tippecano	8/25/04	41.32453	-85.76	62	4.0	2					2			1							2	2
Tippecano	8/25/04	41.3243	-85.7589	63	4.0	5								5							1	1
Tippecano	8/25/04	41.32444	-85.7575	64	5.0	5								5							1	1
Tippecano	8/25/04	41.32462	-85.757	65	17.0	0															0	0
Tippecano	8/25/04	41.32403	-85.7568	66	4.0	5								5							1	1
Tippecano	8/25/04	41.32337	-85.757	67	5.0	1	1							1		1					3	2
Tippecano	8/25/04	41.32281	-85.7569	68	16.0	4			4												1	1
Tippecano	8/25/04	41.32234	-85.7573	69	4.0	5								5							1	1
Tippecano	8/25/04	41.32198	-85.7571	70	9.0	3	1							2							2	1
Tippecano	8/25/04	41.32149	-85.7572	71	3.0	2								2		1					2	2
Tippecano	8/25/04	41.32114	-85.7566	72	6.0	4								4							1	1
Tippecano	8/25/04	41.32091	-85.7559	73	9.0	5	1		1			4		5							4	3
Tippecano	8/25/04	41.32081	-85.7551	74	6.0	2								2							1	1
Tippecano	8/25/04	41.32024	-85.7554	75	9.0	5	1		3			5									3	2
Tippecano	8/25/04	41.31986	-85.7564	76	7.0	5								5							1	1
Tippecano	8/25/04	41.31984	-85.7571	77	3.0	1								1							1	1
Tippecano	8/25/04	41.31922	-85.757	78	3.0	1				1				1							2	2
Tippecano	8/25/04	41.31901	-85.7558	79	9.0	5			1			5									2	2
Tippecano	8/25/04	41.31866	-85.7547	80	3.0	1	1		1	1					1						4	3
Tippecano	8/25/04	41.31882	-85.7535	81	18.0	0															0	0
Tippecano	8/25/04	41.318	-85.7534	82	6.0	1		1	1	1				1	1						5	4
Tippecano	8/25/04	41.31704	-85.7533	83	3.0	3				1				2		1					3	3
Tippecano	8/25/04	41.31673	-85.7522	84	4.0	4				1				3							2	2
Tippecano	8/25/04	41.31752	-85.7516	85	6.0	5	1					1		5							3	2
Tippecano	8/25/04	41.31758	-85.7503	86	4.0	5								5			2				2	2
Tippecano	8/25/04	41.31784	-85.7491	87	3.0	3				1				3							2	2
Tippecano	8/25/04	41.31856	-85.7486	88	4.0	0														1	0	0
Tippecano	8/25/04	41.31922	-85.7478	89	5.0	0														1	0	0
Tippecano	8/25/04	41.31982	-85.7473	90	8.0	3	2					1		1							3	2
Tippecano	8/25/04	41.31914	-85.747	91	4.0	0														1	0	0
Tippecano	8/25/04	41.31861	-85.7464	92	3.0	1								1						1	1	1
Tippecano	8/25/04	41.31849	-85.7451	93	2.0	0														1	0	0
Tippecano	8/25/04	41.31928	-85.7448	94	5.0	0														1	0	0
Tippecano	8/25/04	41.31998	-85.7442	95	7.0	1	1													1	1	0
Tippecano	8/25/04	41.3199	-85.7431	96	4.0	1		1												1	1	0
Tippecano	8/25/04	41.31946	-85.742	97	3.0	2			1	1		1		1							4	4
Tippecano	8/25/04	41.32006	-85.7408	98	3.0	1			1											1	1	1
Tippecano	8/25/04	41.3209	-85.7414	99	4.0	3								3						1	1	1
Tippecano	8/25/04	41.32103	-85.7427	100	7.0	0														1	0	0
Tippecano	8/25/04	41.32139	-85.7439	101	13.0	0															0	0
Tippecano	8/25/04	41.32199	-85.7425	102	10.0	5			5												1	1
Tippecano	8/25/04	41.32239	-85.7411	103	6.0	0														1	0	0
Tippecano	8/25/04	41.32291	-85.7399	104	3.0	0			4											1	1	1
Tippecano	8/25/04	41.32355	-85.7407	105	6.0	5	2													1	1	0
Tippecano	8/25/04	41.32331	-85.7413	106	7.0	0														1	0	0
Tippecano	8/25/04	41.32416	-85.7421	107	4.0	5								5		1					2	2
Tippecano	8/25/04	41.32376	-85.7433	108	6.0	5	1							5							2	1
Tippecano	8/25/04	41.32317	-85.744	109	11.0	3			3												1	1
Tippecano	8/25/04	41.32461	-85.7444	110	4.0	2				1				2							2	2
Tippecano	8/25/04	41.32413	-85.7457	111	4.0	4			1			1		3							3	3
Tippecano	8/25/04	41.32338	-85.7466	112	4.0	5								5			1				2	2
Tippecano	8/25/04	41.32301	-85.7479	113	7.0	5								5			1	1			3	3

Species Codes	
BIBE	Bur marigold
CEDE4	Coontail
CH?AR	Chara
ELCA7	Elodea
LEMN	Duckweeds
MYHE	Broadleaf watermilfoil
MYSI	Northern watermilfoil
MYSP2	Eurasian watermilfoil
MYVE	Whorled watermilfoil
NAFL	Slender naiad
NAGU	Southern waternymph
NAMA	Spiny naiad
NAMI	Brittle waternymph
NELU	American lotus
NI?TE	Nitella
NOAQVG	No aquatic vegetation
NULU	Yellow pond lily
NYTU	White water lily
POAM	Large-leaf pondweed
POCR3	Curly-leaf pondweed
POFO3	Leafy pondweed
POGR8	Variable pondweed
POIL	Illinois pondweed
PONO2	American pondweed
POPE6	Sago pondweed
POPR5	White-stemmed pondweed
POPU7	Small pondweed
PORI2	Richardson's pondweed
POZO	Flat-stemmed pondweed
UTMA	Common bladderwort
VAAM3	Wild celery, eel grass
WO?LF	Watermeal
ZAPA	Horned pondweed
ZODU	Water stargrass
Count	34

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	NAFL	POPE6	POPU7	VAAM3	POZO	PORI2	POGR8	ZODU	POIL	ALGA	SpeNum	NatSpeNum
Tippecano	8/25/04	41.32379	-85.7494	114	3.0	3								3							1	1
Tippecano	8/25/04	41.32425	-85.751	115	6.0	5								5				1			2	2
Tippecano	8/25/04	41.32459	-85.7518	116	15.0	3			3												1	1
Tippecano	8/25/04	41.32556	-85.7513	117	4.0	5								5							1	1
Tippecano	8/25/04	41.32654	-85.7517	118	4.0	4				1				4							2	2
Tippecano	8/25/04	41.32734	-85.7529	119	6.0	5								5							1	1
Tippecano	8/25/04	41.32772	-85.7543	120	4.0	2				1				1							2	2
Tippecano	8/25/04	41.3272	-85.7558	121	4.0	3								3							1	1
Tippecano	8/25/04	41.32694	-85.7567	122	12.0	1								1							1	1
Tippecano	8/25/04	41.32779	-85.7575	123	6.0	5								5							1	1
Tippecano	8/25/04	41.32888	-85.7583	124	3.0	3					1			3							2	2
Tippecano	8/25/04	41.3291	-85.7596	125	9.0	3			1					1				2			3	3
Tippecano	8/25/04	41.33007	-85.7603	126	6.0	5								5				2			2	2
Tippecano	8/25/04	41.33114	-85.7608	127	4.0	5	1					1		5		1					4	3
Tippecano	8/25/04	41.33231	-85.7614	128	16.0	5								5							1	1
Tippecano	8/25/04	41.33349	-85.7619	129	7.0	3	1	1				1		1					1		5	3
Tippecano	8/25/04	41.33461	-85.7629	130	6.0	3								1		1		2			3	3
Tippecano	8/25/04	41.33572	-85.7641	131	3.0	1				1	1					1					3	3
Tippecano	8/25/04	41.33658	-85.7655	132	4.0	5	1							5				2	1		4	3
Tippecano	8/25/04	41.33779	-85.767	133	6.0	5								5							1	1
Tippecano	8/25/04	41.33769	-85.7685	134	6.0	3	1			1		1		2							4	3
Tippecano	8/25/04	41.33721	-85.7698	135	4.0	1				1	1					1					3	3
Tippecano	8/25/04	41.33702	-85.7714	136	5.0	3	3	1								1					3	1
Tippecano	8/25/04	41.33737	-85.773	137	5.0	1								1	1						2	2
Tippecano	8/25/04	41.33691	-85.7743	138	4.0	1									1						1	1
Tippecano	8/25/04	41.33634	-85.7746	139	13.0	5			5												1	1
Tippecano	8/25/04	41.33636	-85.7757	140	4.0	1				1											1	1
Tippecano	8/25/04	41.33564	-85.7765	141	16.0	3			3												1	1
Tippecano	8/25/04	41.33511	-85.7776	142	5.0	0															0	0
Tippecano	8/25/04	41.33606	-85.7782	143	3.0	3				2	1			1							3	3
Tippecano	8/25/04	41.33552	-85.7791	144	2.0	2				2											1	1
Tippecano	8/25/04	41.33494	-85.7798	145	5.0	5			1	3				3							3	3
Tippecano	8/25/04	41.33435	-85.7794	146	19.0	1			1												1	1
Tippecano	8/25/04	41.33321	-85.7786	147	6.0	3				3											1	1
Tippecano	8/25/04	41.33257	-85.7788	148	3.0	1								1							1	1
Tippecano	8/25/04	41.3321	-85.778	149	13.0	5			5					1							2	2
Tippecano	8/25/04	41.3313	-85.7781	150	3.0	3				3											1	1
Tippecano	8/25/04	41.33013	-85.7784	151	4.0	1									1						1	1
Tippecano	8/25/04	41.33042	-85.7793	152	3.0	1				1				1							2	2
Tippecano	8/25/04	41.32986	-85.7796	153	19.0	1			1												1	1
Tippecano	8/25/04	41.33006	-85.7805	154	6.0	3	1		2					1							3	2
Tippecano	8/25/04	41.32991	-85.7815	155	3.0	3				3											1	1
Tippecano	8/25/04	41.32946	-85.7816	156	5.0	2								2						1	1	1
Tippecano	8/25/04	41.32884	-85.7806	157	4.0	3				3				1							2	2
Tippecano	8/25/04	41.32835	-85.7796	158	6.0	1	1							1							2	1
Tippecano	8/25/04	41.32835	-85.7787	159	8.0	4	1		1					3							3	2

Species Codes	
BIBE	Bur marigold
CEDE4	Coontail
CH?AR	Chara
ELCA7	Elodea
LEMN	Duckweeds
MYHE	Broadleaf watermilfoil
MYSI	Northern watermilfoil
MYSP2	Eurasian watermilfoil
MYVE	Whorled watermilfoil
NAFL	Slender naiad
NAGU	Southern waternymph
NAMA	Spiny naiad
NAMI	Brittle waternymph
NELU	American lotus
NI?TE	Nitella
NOAQVG	No aquatic vegetation
NULU	Yellow pond lily
NYTU	White water lily
POAM	Large-leaf pondweed
POCR3	Curly-leaf pondweed
POFO3	Leafy pondweed
POGR8	Variable pondweed
POIL	Illinois pondweed
PONO2	American pondweed
POPE6	Sago pondweed
POPR5	White-stemmed pondweed
POPU7	Small pondweed
PORI2	Richardson's pondweed
POZO	Flat-stemmed pondweed
UTMA	Common bladderwort
VAAM3	Wild celery, eel grass
WO?LF	Watermeal
ZAPA	Horned pondweed
ZODU	Water stargrass
Count	34

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	MYSP2	POCR3	CEDE4	CH?AR	NAFL	POPE6	VAAM3	ELCA7	POFO3	POZO	POFO3	POGR8	NAMA	ZODU	UTMA	ALGA	SpeNum	NatSpeNum	Species Codes	
James	8/26/04	41.32285	-85.7336	160	7.0	3		1	3				3			1							4	3	BIBE	Bur marigold
James	8/26/04	41.3227	-85.7324	161	3.0	1				1	1												2	2	CEDE4	Coontail
James	8/26/04	41.32261	-85.7314	162	12.0	3			5														1	1	CH?AR	Chara
James	8/26/04	41.32192	-85.731	163	3.0	3	2						1									1	2	1	ELCA7	Elodea
James	8/26/04	41.32131	-85.7304	164	13.0	5			1														1	1	LEMN	Duckweeds
James	8/26/04	41.32044	-85.7303	165	4.0	5	1		1			2	3										4	3	MYHE	Broadleaf watermilfoil
James	8/26/04	41.31961	-85.7301	166	19.0	1																	0	0	MYSI	Northern watermilfoil
James	8/26/04	41.31859	-85.7305	167	6.0	2	1						2										2	1	MYSP2	Eurasian watermilfoil
James	8/26/04	41.31784	-85.7297	168	2.0	4	1			1			3										3	2	MYVE	Whorled watermilfoil
James	8/26/04	41.31706	-85.7292	169	4.0	2	1		1	2			1			1							5	4	NAFL	Slender naiad
James	8/26/04	41.31631	-85.7293	170	4.0	1				1													1	1	NAGU	Southern waternymph
James	8/26/04	41.3158	-85.7297	171	5.0	3			1			1	2										3	3	NAMA	Spiny naiad
James	8/26/04	41.31496	-85.73	172	3.0	4				3		1	1										3	3	NAMI	Brittle waternymph
James	8/26/04	41.31431	-85.7297	173	10.0	5			5														1	1	NELU	American lotus
James	8/26/04	41.31402	-85.7308	174	7.0	5			5												1		2	2	NI?TE	Nitella
James	8/26/04	41.31354	-85.7307	175	15.0	0																	0	0	NOAQVG	No aquatic vegetation
James	8/26/04	41.31291	-85.7302	176	3.0	3				3													1	1	NULU	Yellow pond lily
James	8/26/04	41.31247	-85.7293	177	8.0	5			5											1			2	2	NYTU	White water lily
James	8/26/04	41.31212	-85.7287	178	10.0	5			5														1	1	POAM	Large-leaf pondweed
James	8/26/04	41.31193	-85.7278	179	3.0	5			1	4	1		1										4	4	POCR3	Curly-leaf pondweed
James	8/26/04	41.31208	-85.727	180	4.0	5			2				5						1				3	3	POFO3	Leafy pondweed
James	8/26/04	41.31234	-85.7262	181	8.0	5			5														1	1	POGR8	Variable pondweed
James	8/26/04	41.31224	-85.7256	182	4.0	2				2				1									2	2	POIL	Illinois pondweed
James	8/26/04	41.31238	-85.7248	183	3.0	2		2	1	1			1										4	3	PONO2	American pondweed
James	8/26/04	41.31275	-85.724	184	3.0	5				2			3										2	2	POPE6	Sago pondweed
James	8/26/04	41.31351	-85.7242	185	4.0	0																1	0	0	POPR5	White-stemmed pondweed
James	8/26/04	41.31411	-85.7247	186	16.0	5			5														1	1	POPU7	Small pondweed
James	8/26/04	41.31415	-85.7239	187	7.0	3	1	1							1								3	1	PORI2	Richardson's pondweed
James	8/26/04	41.31394	-85.7229	188	3.0	4				3			1		3								3	3	POZO	Flat-stemmed pondweed
James	8/26/04	41.31419	-85.7224	189	4.0	5				1			5										2	2	UTMA	Common bladderwort
James	8/26/04	41.3149	-85.7224	190	18.0	5			5														1	1	VAAM3	Wild celery, eel grass
James	8/26/04	41.31551	-85.7217	191	4.0	1			1													1	1	1	WO?LF	Watermeal
James	8/26/04	41.31617	-85.7214	192	4.0	5			1		1		5							1			4	4	ZAPA	Horned pondweed
James	8/26/04	41.31657	-85.7225	193	12.0	1			1														1	1	ZODU	Water stargrass
James	8/26/04	41.31702	-85.7231	194	11.0	5			5														1	1		
James	8/26/04	41.31784	-85.7234	195	3.0	1				1													1	1	Count	34
James	8/26/04	41.31854	-85.7235	196	5.0	5	1						5							1			3	2		
James	8/26/04	41.31909	-85.7229	197	3.0	2				1	1												2	2		
James	8/26/04	41.31961	-85.7231	198	5.0	5		1	1		3		1										4	3		
James	8/26/04	41.32015	-85.723	199	3.0	3				1	2							1					3	3		
James	8/26/04	41.32076	-85.7229	200	5.0	5	1			3	3					1							4	3		
James	8/26/04	41.32143	-85.7231	201	4.0	1	1			1													2	1		
James	8/26/04	41.32198	-85.7239	202	12.0	5			5														1	1		
James	8/26/04	41.3226	-85.7243	203	5.0	4				4			1					1					3	3		
James	8/26/04	41.3233	-85.725	204	3.0	3				2	1							1					3	3		
James	8/26/04	41.32338	-85.7261	205	7.0	5			2				5										2	2		
James	8/26/04	41.32373	-85.7271	206	5.0	2	1			1			1										3	2		
James	8/26/04	41.32365	-85.7284	207	6.0	3	2	1		1						1							4	2		
James	8/26/04	41.32391	-85.7292	208	3.0	5					5		1										2	2		
James	8/26/04	41.32391	-85.7299	209	20.0	3			3														1	1		
James	8/26/04	41.32452	-85.7307	210	4.0	5	1		1				5										3	2		
James	8/26/04	41.32484	-85.7313	211	4.0	2	1		1	2													3	2		
James	8/26/04	41.32507	-85.732	212	18.0	5			5														1	1		
James	8/26/04	41.32576	-85.7327	213	3.0	5			5					1				1					3	3		
James	8/26/04	41.32581	-85.7333	214	4.0	5		1	5					3									3	2		
James	8/26/04	41.32551	-85.7337	215	19.0	1			1														1	1		
James	8/26/04	41.32547	-85.7344	216	5.0	5			5														1	1		
James	8/26/04	41.32519	-85.7352	217	4.0	3			2			1	1			1							4	4		
James	8/26/04	41.3249	-85.7355	218	9.0	5			5				2										2	2		
James	8/26/04	41.32437	-85.7359	219	4.0	3	1				1		3										3	2		
James	8/26/04	41.32388	-85.7359	220	9.0	5			5							1							2	2		
James	8/26/04	41.32325	-85.7358	221	3.0	5	1		1	1			4										4	3		
James	8/26/04	41.32314	-85.7352	222	17.0	2			2														1	1		
James	8/26/04	41.32267	-85.7345	223	6.0	3			2				1							2			3	3		